Patent
Attorney Docket No.: 949797-100029-US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Inventor(s): Goldsmith, Edward M., and DeLap, Christopher K.

Serial No.: 10/759,525

Filed: January 16, 2004

For: Hockey Stick

Customer No.: 34026

Confirmation No.: 7039

Group Art Unit: 3711

Examiner: Mark S. Graham

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This brief is an appeal from the Final Office Action mailed May 9, 2006, finally rejecting claims 30-37, 40, 42-49, and 108-110. A Notice of Appeal was filed by U.S. Mail and is dated received by the Patent Office on November 13, 2006, the time for filing this Appeal Brief thereby being set for January 13, 2007. Accordingly, a petition for a five month extension of time

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LAI-2875344v1

accompanies this Appeal Brief. It is submitted that the application and claims are properly formed and the issues distilled and ripe for appeal.

I. REAL PARTY IN INTEREST

The real party in interest is Easton-Bell Sports, Inc., the assignee of the present application as set forth in the assignment recorded at Reel 017746, Frame 0609, dated June 9, 2006. Easton-Bell Sports, Inc. is a wholly owned subsidiary of RBG Holdings Corp., which is owned by EB Sports Corp., which is owned by parent company Easton-Bell Sports, LLC.

II. RELATED APPEALS AND INTERFERENCES

With respect to other appeals that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal, the appeal of Application Serial No. 10/439,652 (filed May 15, 2003) is identified. This appeal was filed on June 13, 2007.

III. STATUS OF CLAIMS

Pending Claims & Claims on Appeal:

Claims 30-37, 40, 42-49, and 108-110 are currently pending in the present application, with claim 30 being the sole independent claim. Each of the claims stand rejected under 35 U.S.C. § 103(a). There are no other grounds of rejection. Claims 30-37, 40, 42-49, and 108-110 are on appeal.

Cancelled & Withdrawn Claims:

Claims 1-29, 38-39, and 50-107 were cancelled in Preliminary Amendment dated January 16, 2004. Claim 41, due to typographical error, never existed.

IV. STATUS OF AMENDMENTS

No amendments have been filed subsequent to the Final Office Action mailed on May 9, 2006.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 30, as amended during prosecution, is directed to a hybrid hockey stick blade comprising a composite paddle portion having a recessed heel permanently coupled to a wooden hosel portion being adapted to being removably coupled to a hockey stick shaft. (See *e.g.*, Figs. 14A-G; Figs. 17A-D; Appl. page 16, line 6 to page 25, line 16; and Appl. page 22, line 20 to page 26, line 11.) The first end section of the hosel portion includes a slot wherein the recessed surfaces of the heel section of the composite paddle are received and permanently coupled. (Id.; see also Figs. 17B, 17C and 17D; Appl. page 22, line 20 to page 24, line 18; Figs. 1, 2, 5 and 6.) The second end section of the hosel portion being adapted to being received within a tubular portion of a hockey stick shaft. (Id.; see also Figs. 17A-D, Appl. page 24, line 19 to page 26, line 11; Figs. 10-13.)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 30-37, 40, 42-49, and 108-110 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Christian (USPNo. 6,039,661) in view of Tiitola (USPNo. 5,407,195).

VII. ARGUMENT

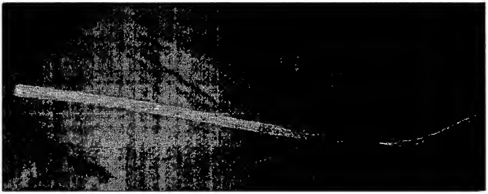
A. Introduction

The invention here is generally directed to hockey sticks and in particular to hybrid hockey stick blades having a unique configuration and construction. To place the invention in the proper context so that it may be fully appreciated, a short discussion of the prior art, specifically the two cited references, and the previously submitted "Declaration of Edward M. Goldsmith Pursuant to 37 C.F.R. § 1.132" (attached hereto as Evidence Appendix Exhibit A), as they relate to the development of the hockey stick art is believed in order.

1. Early Hockey Sticks Were Unitary Structures Carved From a Single Piece of Wood

As explained in the Background Section of the subject application, hockey sticks are generally comprised of a blade portion and an elongated shaft portion which allows the player to manipulate or communicate with the blade during play. Because the blade is the part of the hockey stick that endures the greatest punishment during the rigors of play, early hockey sticks manufactured through the first decades of the 1900s were carved from a *single piece* of wood. (See *e.g.*, Goldsmith Declaration ¶ 14.) The idea being that a unitary hockey stick, wherein the blade and the shaft were seamless unitary extensions of one another, could endure greater stress than hockey sticks formed of one or more separately made and joined components. (Id.) The hockey stick illustrated below is representative of such a single piece construction. (Id.)

Early Carved Single Piece Hockey Stick



In later versions, wood hockey sticks were constructed with the blade and shaft being formed from different pieces of wood and permanently connected together. This construction, while reducing waste, further weakened the area between the blade and shaft. (Id. at ¶¶ 16-22.)

2. The Replaceable Blade Hockey Stick Configuration and USPNo. 5,303,916 issued on April 19, 1994 to Aubrey Rodgers

As further described in the Background Section of the subject application, hockey sticks constructed of wood, although providing a "feel" that many hockey players prefer, or perhaps over the years have become accustomed to, nevertheless continued to have many shortcomings.

First and foremost, wood hockey sticks lacked durability often due to fractures in the blade, which frequently occurred at the joint between the blade and the shaft. (Goldsmith Declaration ¶22.) Thus, frequent replacement was required. (Id.) This is not surprising given the substantial and sudden impacts received by the blade during the normal course of play (*e.g.*, swinging the blade at high speed at hard vulcanized rubber pucks, slapping the blade on the ice, smashing the blade into (or between) the rink boards goal bars, skates, etc.). (Id.) Furthermore, due to the variables inherent in wood construction and manufacturing techniques, wood sticks were often difficult to manufacture to consistent tolerances (*e.g.*, the curve and flex of the blade often varied even with the same model and brand of stick). (Id.) Thus, when the stick was no longer in usable condition, the player was left without a seamless and comfortable replacement. (Id.) Moreover, because the blade and the shaft were permanently attached to one another, the durability of wood hockey sticks was dependent on the durability of each component. (Id.) As such, it was not uncommon for an unusable wood hockey stick to be scrapped with a shaft that was in good condition. Consequently, significant waste of natural resources occurred in that, of the two components, the shaft component comprises the vast majority of the wood that is employed in making the stick.

As explained in U.S. Patent No. 5,303,916 issued on April 19, 1994, in the name of Aubrey Rodgers (previously cited, attached hereto as Evidence Appendix Exhibit B), in an attempt to improve upon the durability of traditional wooden hockey stick constructions, contemporary hockey

stick design -- with the advent of tubular non-wooden hockey stick shafts -- increasingly veered away from the traditional permanently attached blade towards a replaceable blade configuration so that a damaged blade could be readily removed from the shaft and replaced with a new blade, to wit:

> Hockey Sticks have traditionally been a one-piece wooden structure. During a typical hockey game, a hockey stick can impact the ice hundreds of times at force levels that often result in fracture or breakage of the stick. Breakage of hockey stick occurs most frequently at the blade portion or at the lower part of the shaft that extends from the blade portion. It is thus fairly common for many hockey players to replace a broken stick at least once during each hockey game.
>
> In an attempt to improve the durability of a hockey stick without sacrificing the characteristics of weight, feel, and flexibility that are desirable in a hockey stick, materials other than wood have been resorted to in constructing hockey sticks. Thus although a wooden hockey stick has set the standard for weight, feel and propulsion of a puck, a new generation of sticks have been formed of plastic and aluminum, as well as laminates of fibrous, plastic and resinous materials. Generally plastic and aluminum provide good strength characteristics for a hockey stick, but the weight, wear and feel of these materials do not command universal acceptance by hockey players.

> Since most hockey players prefer a wooden hockey blade, much attention has been directed to the development of a durable, non-wooden hockey stick shaft that can be used with a wooden blade but is less likely to break than a wooden shaft. One result of such development effort is a hollow aluminum or fibrous hockey stick shaft capable of receiving a replaceable blade that can be formed of wood or plastic.
>
> For example, U.S. Pat. No. 4,086,115 to Sweet et al. shows a hollow hockey stick shaft made from graphite fiber and resin. The hockey stick includes a wooden blade with a tongue that engages one end of the hollow shaft and is bonded therein with a polyester resin mixture. It has been found that hollow shafts formed of graphite fiber and resin as disclosed in this patent are more durable than wooden shafts but are still prone to fracture under the usual forces that a stick is subject to in a hockey game.

('916 Patent at Col. 1, lines 14-54).

As indicated in the '916 patent, initially the tubular shafts were formed of aluminum and fibrous plastics. (Goldsmith Declaration ¶ 24.) However, since most hockey players preferred a wooden hockey blade, the blades in these replaceable blade configurations continued to be made of wood. (Id.) In order to retain a uniform hitting surface of the blade while providing a means to connect the blade to the shaft, the blades were configured to include an upward extension from the heel -- often referred to as a "tennon," "shank," or "hosel" -- that was dimensioned at its upper region to be received within the lower end of the tubular shaft so as to generally form a four-plane lap joint.

(Id. at ¶¶ 25-26.) In this manner, the entire blade could be uniformly constructed even at the heel region. (Id.) This two-piece configuration with an upward hosel extension from the blade improved durability of the hockey stick in three aspects. First the shaft was protected from the high impact region at the heel of the blade. Second, the shaft, being made of fiber reinforced resin or aluminum, was more durable than the previously employed wooden shafts. Third, because the configuration facilitated reuse of the shaft with new blades, the waste previously incurred when the blade was fractured was significantly reduced. Notably however, these improvements did not overcome the lack of durability and uniformity of the wooden blade. (Id. at ¶ 27.) Notwithstanding the many advantages of synthetic replacement blades, there continued to be a significant number of players that preferred the traditional wooden hockey stick even though more durable synthetic replaceable blades became increasingly available. (Id. at ¶ 31.)

3. Composite Blades and USPNo. 5,507,195 to Tiitola et al.

As described in U.S. Patent No 5,407,195 issued on April 18, 1995 to Antti-Jussi Tiitola et al. (attached hereto as Evidence Appendix Exhibit C), there was a perception by those of skill in the art that the continued preference for traditional wooden hockey sticks was due to the failure of synthetic blades to provide physical attributes (*e.g.*, stiffness, flex, weight, etc.) comparable to wooden blades while providing improved durability:

> A blade for a hockey stick must be extremely strong in order for it to indure [sic] the tremendous forces developed between it and a puck. On the other hand, the blade must have a certain amount of flexibility so that the player has an acceptable level of "feel" while handling a puck or executing a shot. The optimum design of a blade furthermore includes a primary concave contact face which places a

further limit on its construction; the blade also usually has a corresponding convex contact face which is more or less parallel to the concave face, i.e. in order to keep the weight of the blade low.

Many types of hockey sticks are presently known.

Traditional blades for ice hockey sticks are made of one or more pieces (e.g. layers) of wood. A shortcoming of wooden blades is that they are generally not strong enough and thus do not hold up well under the usual conditions encountered when playing hockey. Moreover, labour and material costs for the manufacture of wooden blades are relatively high.

A wooden blade may also be reinforced with fiber (e.g. glass) fabric which is impregnated and bonded to the wooden surface with a synthetic resin. These types of reinforced wooden blades have given good results including good playing performance, this performance is mainly the result of the combination of low weight and high stiffness.

Blades made entirely out of synthetic materials are also known; these include composite blades comprising a fiber (e.g. glass) laminated core (see for example U.S. Pat. Nos. 4,059,269, 4,488,721, 4,591,155, 4,600,192, Finish Pat. No. 65018, etc.) However, difficulties are still encountered in providing a (synthetic) composite blade for a hockey stick that can withstand the substantial impacts to which it is subjected during use yet provide a "feel" comparable to that of traditional wooden sticks when handling the puck and executing a

> shot. Plastic blades may, for example, have good strength characteristics but may have (high) weight, (low) wear and/or feel (i.e. low stiffness) characteristics which may be unacceptable to some players. It is possible, for example, to obtain a light weight blade having good stiffness by using a core of polyurethane foam, but, such a core may have a limited shear strength which may lead to internal fracture of the blade during use.
>
> Accordingly, it would advantageous to have an alternative composite blade construction for a hockey stick or the like which may be strong, durable, light weight and of acceptable stiffness.

('195 patent at Col. 1, lines 19-68). In an attempt to overcome this perceived shortcoming, Tiitola et al. disclosed a hockey stick blade construct in which the blade comprised a first face member and a second opposed face member. The first and second face members being spaced apart and formed of fiber reinforced plastic materials. Sandwiched between the first and second face members is a core cavity member comprising one or more bridge members of fiber reinforced plastics material. The first face member, the second face member and the bridge members are integral, and one or more of the bridge members are integral, and one or more of the bridge members comprises a fiber reinforcing component oriented transversely with respect to the first and second face members.

Although such composite hockey stick structures had many objective benefits, as set forth in the background section of the subject application, ***many players continued to prefer the feel of wooden hockey sticks***. (Goldsmith Declaration ¶ 33.) The inventors in the pending application realized that the preference for wooden hockey stick was perhaps less a derivative of the fact that the hockey sticks themselves were made of wood, but rather a derivative of the manner by which

traditional wood hockey sticks were constructed. (Id. at ¶ 34.) In other words, while the industry perceived the preference for wooden hockey sticks as one of materials, the inventors --***contrary to industry perceptions*** -- perceived the preference as being not only the materials but also the manner by which the blade and shaft in traditional wood hockey stick constructions were mated or joined. (Id.)

The result of the inventors' insight is a hybrid hockey stick blade of unique configuration and construction that is adapted to being joined to a hockey stick shaft in a manner that provides the characteristics that allow a hockey player a comfortable "feel," while providing the player with the desired performance and durability. (Id. at ¶ 35.)

B. The Combination of Christian et al. (USPNo. 6,039,661) and Tiitola et al. (USPNo. 5,047,195) Do Not Render Obvious The Claims At Issue

1. Independent Claim 30 And The Examiner's Rejection

Independent Claim 30, the only independent claim presented on appeal and amended during prosecution, is as follows:

Claim 30 (Currently amended): A hybrid hockey stick blade adapted to being removably coupled to a hockey stick shaft comprising:

a composite paddle portion comprising:

i. an elongate member extending from a tip section to a heel section and having a front face and a back face;

ii. the heel section comprising front-side and back-side facing surfaces that are recessed relative to adjacent portions of the front and back faces;

iii. the elongate member further comprising an inner foam core and one or more plies disposed within a hardened resin matrix material overlaying the inner

foam core, wherein the one or more plies comprise fibers aligned in one or more defined directions; and

a wooden hosel portion comprising:

i. an adapter member constituted at least in part of wood and extending longitudinally from a first end section to a second end section;

ii. the first end section includes a slot wherein the recessed surfaces of the heel section are received and permanently coupled thereto; and

iii. the second end section being adapted for receipt within a tubular portion of a hockey stick shaft,

wherein a portion of said fibers being interposed between one or more of the recessed heel section surfaces and an overlying inner surface defining the slot in the first end-section of the hosel portion.

Thus, as amended, independent claim 30 is directed to a hybrid hockey stick comprising a composite paddle portion having a recessed heel permanently coupled to a wooden hosel, which in turn is adapted for receipt by a tubular hockey stick shaft.

In rejecting Claim 30, the Office Action mailed May 9, 2006 misinterprets the disclosure and teachings of the cited prior art references. Specifically, the rejection of claim 30 (after the amendments of March 14, 2006) is conclusory, devoid of any discussion of the present claim limitations, and erroneously assumes those claim limitations exist in the prior art, which they do not. The rejection set forth in the Office Action of May 1, 2006, is as follows:

> "Concerning the amendments to claim 30, when a fiber composite blade such as Tiitola's is joined at the hosel in the manner disclosed by Christian, the fibers of the blade necessarily have to be between the recessed heel section and the slot."

* * *

> "In response to applicant's arguments and the submitted declaration, it is the examiner's opinion that Christian discloses the claimed device with the exception of the type of blade used. However, numerous blade constructs are known in the art including that of Tiitola which meets the limitations of the blade claimed by applicant. Moreover, Tiitola provides a specific teaching that blades such as his are intended to improve upon blades such as Christian's. (See again Col. 1 of Tiitola). Thus, the ordinarily skilled artisan has been presented with the blade fastening being claimed (Christian), the type of blade being claimed (Tiitola) and a specific teaching in the references themselves to improve the blade of the Christian type with one of the Tiitola construction. As such the ordinarily skilled artisan would have had a strong motivation to combine the references which results in arrival of the applicant's claimed invention. Under 35 U.S.C. 103 therefore the Examiner cannot find the claimed blade to be patentable."

As indicated, the above rejection wholly fails to address several pertinent claim limitations, *e.g.*, (i) a composite blade with a recessed heel, (ii) fibers interposed between the recessed heel and the wooden hosel, and (iii) a wooden hosel permanently coupled to a composite paddle portion and adapted for receipt within a tubular hockey stick shaft. These are not taught or suggested by the cited references. The rejection does not explicitly address these key differences between claim 30 as written and the prior art. Moreover, neither cited reference teaches or even suggests combining any aspect of the wood blade construct of Christian et al. (attached hereto as Evidence Appendix Exhibit D) with any aspect of the synthetic blade construct disclosed in Tiitola et al., let alone to combine those features in the manner claimed. Plainly, none of the identified claim limitations appear in the prior art.

On these points, the Supreme Court in *KSR Int'l Co. v. Teleflex* recently stated:

> Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an ***apparent reason*** to combine the ***known elements*** in the fashion claimed by the patent at issue. ***To facilitate review, this***

> ***analysis should be made explicit.*** See *In re Kahn, 441 F.3d 977, 988 (CA Fed. 2006)* ("Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.)
>
> * * *
>
> ***Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.*** This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. (Emphasis added.)

KSR Int'l Co. v. Teleflex, 127 S. Ct. 1727, *1740-41, 167 L. Ed. 2d 705, **722 (April 30, 2007). Further, not only do the claimed limitations not exist in the prior art relied upon in the rejection, the rejection's discussion of the "known elements" refers only to "the blade" of each reference, and not—as required by *KSR*—to any elements of those blades. In other words, the rejection simply fails to identify the "known elements" of the prior art, no doubt because the blades of Tiitola et al. and Christian et al. do not contain the claimed features.

The rejection is further in violation of the policy of the Patent Office, as explained in the Memorandum from Margaret A. Focarino, Deputy Commissioner for Patent Operations, dated May 3, 2007 (attached hereto as Evidence Appendix Exhibit E), which states that the Patent Office policy ***remains*** one of identifying the "reason" why the "prior art elements" would have been combined.

> **"Therefore in formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, *it remains* necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed," citing KSR. (Bold emphasis in original of Memorandum; italics emphasis added)**

Plainly, the rejection does not provide an identification of the element or elements in the prior art or an "explicit analysis" of the cited art because the relevant claim limitations simply do not exist in the

prior art, *e.g.*, a composite blade with a recessed heel, fibers interposed between a recessed heel surface and a wood hosel, and a wooden hosel permanently coupled to a composite paddle portion and for receipt with a tubular hockey stick shaft.

2. Neither Christian nor Tiitola teaches, suggests or provides motivation to combine any aspect of the wood replacement blade in Christian with any aspect of the synthetic blade construct in Tiitola, let alone to combine features in the manner claimed

While Tiitola et al. discloses a ***composite blade*** construction, it fails to disclose, suggest or otherwise teach a recessed heel section that is permanently mated within a slot of a wooden hosel. Quite the contrary, the blade constructs disclosed in Tiitola et al. have absolutely ***no recess at the heel***, let alone one that is configured to be received in a mating portion of a hosel that is adapted for receipt within a tubular portion of a hockey stick shaft. Thus, the rejection imports into the Tiitola et al. reference a feature which does not exist, and for which there is no teaching or suggestion – a recessed heel portion.

Christian et al., on the other hand, discloses an ***all wood hockey replacement blade*** having an exterior overlay of fiberglass including a pair of "reinforcement strips," (Col. 3, lines 1-50), but fails to disclose, suggest, or otherwise teach that any wooden portion of the blade be formed of foam. The replacement blade of Christian et al. is simply a wood blade ***wrapped*** with fiberglass and dipped in varnish. The primary strength of the blade disclosed in Christian et al. is derived from the wood construction, which may or may not be further protected by a fiberglass overlay. See Christian et al. at Col. 6, lines 57-67. In contrast to wood, a foam core such as that identified in the rejection and attributable to Tiitola et al. has very little strength. Rather, a foam core is employed in synthetic blade construction during the curing process -- one neither taught nor even suggested by Christian et al. -- to provide the necessary internal pressure to mold the fiber plies within the resin. Indeed, one

of ordinary skill in the art would not replace the wood components of the replacement blade of Christian et al. with foam (even with a protective fiberglass woven sleeve), because to do so would undermine the integrity of the blade structure disclosed in Christian et al.

Hence, there is simply no teaching in either Christian et al. or Tiitola et al. of the ***hybrid hockey stick*** with a composite blade, wooden hosel and tubular shaft, ***as claimed***. Neither reference teaches or even suggests combining any aspect of the wood blade construct disclosed in Christian et al. with any aspect of the synthetic blade construct disclosed in Tiitola et al., let alone to combine features of those references in the manner claimed. Indeed, as set forth in Goldsmith Declaration, discussed *infra*, there is absolutely no motivation to employ a tongue and groove joint construction at a heel region of a synthetic replacement hockey stick blade because such a joint would be contrary to durability that was sought from such blades. Moreover, such a blade construct would introduce a lack of uniformity in the primary hitting surfaces, *i.e.*, composite and wood.

Additionally, the amendments to claim 30 further require that the fibers be ***interposed between*** a surface of the recessed heel section of the elongate member and an overlying inner surface defining the slot in the first end-section of the hosel portion. Neither reference discloses or even suggests this limitation. Notably, Tiitola et al. neither discloses a slot nor a recessed heel region as claimed, and Christian et al. does not disclose fibers except in the context of an optional fiberglass protective wrap ***over the exterior*** surface of the entire wood blade. See Christian et al. at Col. 6, lines 57-67. With regard to dependent claims 31-35, none of the additional fiber limitations is identified in the referenced prior art.

In addition, it is noted that the additional limitations set forth in dependent claims 43 and 45 are not disclosed in either Tiitola et al. or Christian et al. Neither reference teaches or suggests an internal bridge structure comprising *non-continuous fibers*, nor internal bridge structures extending

between the *recessed front-side and back side facing surfaces of the heel section.* All of the bridge structures in Tiitola et al. are made of layers of *continuous* fibers capable of being oriented at the desired *transverse* angle. Furthermore, since Tiitola et al. does not disclose or even suggest the employment of any recessed portion at the heel whatsoever, it cannot suggest that bridge structures be employed in that region as defined in claim 45. Accordingly, claims 43 and 45 are not obvious over the cited references for these additional reasons.

With regard to dependent claims 109 and 110, Christian et al. does not disclose the use of a composite blade with a wooden laminate hosel.

Finally, it is respectfully submitted that any conclusion that the pending claims are obvious over the two cited references amounts to nothing more than ***impermissible hindsight*** that fails to comprehend the context of the present ***hybrid*** hockey stick invention. Accordingly, it is respectfully submitted that pending claims 30-37, 40, 42-49, and 108-110 patentably distinguish over the prior art.

C. Applicant's Evidence Regarding Commercial Success (the Goldsmith Declaration) Establishes That The Combination is Non-Obvious

In support of the patentability of the claims, the previously submitted "Declaration of Edward M. Goldsmith Pursuant to 37 C.F.R. § 1.132" further evidences the non-obviousness of the claimed invention. Specifically, the Goldsmith Declaration serves the dual purpose of placing the claimed invention in the proper context vis-a-vis the prior art while also setting forth the commercial success of applicant's products embodying the invention. The Goldsmith Declaration with exhibits is incorporated herein by reference and attached to the Evidence Appendix and filed herewith.

In response to the Goldsmith Declaration, the Office Action of May 9, 2006 states, in conclusorily fashion and without any further discussions, that there exists

"no nexus between the commercial success alleged and the particularly claimed features of the hockey stick blade has been shown."

A close examination of the Goldsmith Declaration plainly shows otherwise.

34. I came to the realization that the preference for wooden hockey sticks was perhaps not only a derivative of the fact that the industry had failed to sufficiently "imitate" the "feel" of wood using synthetic materials construction materials, but that the preference may also be derivative of the manner by which the shaft and the blade of traditional wood hockey sticks were joined. ***In other words, while the industry perceived the preference for traditional wooden hockey sticks as primarily one of materials, I -- contrary to industry perceptions -- perceived the preference not only in terms of materials but also in terms of the manner by which the shaft and blade of traditional wood hockey sticks were mated or joined in such traditional hockey sticks.***

35. ***The result of this realization is embodied in the hybrid hockey stick blade constructions and configurations disclosed in the subject patent application***, which was first filed on September 15, 2000.

36. Prior to 2001 there were generally three categories of replacement hockey stick blades -- wood, plastic, and composite. See **Exhibit H** discussed below. The three categories, as previously noted, are descriptive of the primary construction materials of the hosel and paddle. Hence for example the hosel and paddle of a "wood" replacement blade are each substantially constructed of wood or wood laminate and are often overlaid with fiberglass to improve durability. The hosel and paddle portions of a "plastic" blade are typically formed as a unitary injection molded structure made of PVC or like material. The hosel and paddle portions of a "composite" blade are typically formed of fibers (e.g., carbon, aramid, graphite, etc.) disposed within a hardened resin matrix material or resin overlaying a core structure such as foam or ABS plastic.

37. In about March 2001, Easton first sold its "Hybrid Replacement Blade" product. Easton continues to sell its Hybrid Replacement Blade products to this day.

38. **Exhibits D-G** are color copies of selected pages from Easton's 2001 through 2004 hockey catalogs depicting the various replacement hockey stick blades that were sold by Easton during those years. For each catalog the selected pages include (1) the front and back cover pages, (2) the pages of the catalog that illustrate Easton's replacement blades being sold that year, and (3) a page that includes a table of each replacement blade model and series thereof

39. As described in the catalog pages (**Exhibits D-G**), Easton's Hybrid Replacement Blades are adapted to being removably coupled to a hockey stick shaft. ***Each Hybrid Replacement Blade comprises a composite paddle portion and a hosel portion constructed of wood. The composite paddle is generally comprised of a foam core overlaid with multiple plies of fibers disposed within a hardened resin matrix. The heel region of the composite paddle is recessed. One end of the hosel portion includes a slot the other is adapted to being received within a tubular portion of a hockey stick shaft.*** The recessed region of the composite paddle is received within the slot and permanently connected thereto.

48. A consolidated summary of the three sub-categories of wood versus composite replacement blade sales set forth on page 6 of the Market Report is presented by year in Table 2 below.

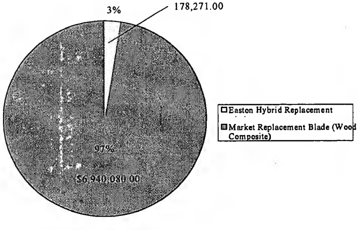
Table 2: Market Summary of Sales of Wood and Composite Replacement Blades

Year	Total Sales of Wood Replacement Blades	Total Sales of Composite Replacement Blade	Total Sales of Composite and Wood Replacement Blades
1999	$11,372,425	$1,811,311	$13,183,735
2000	$10,752,132	$2,710,093	$13,462,225
2001	$5,761,073	$1,179,007	$6,940,080
2002	$8,138,306	$4,235,587	$12,373,893
2003	$5,060,398	$6,787,624	11,848,022

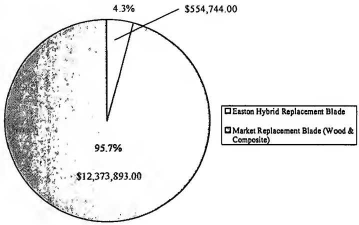
49. Notably, the industry-wide composite replacement blade sales figures during the time-span in which Easton's Hybrid Replacement Blade products were on the market were generally trending upwards while at the same time-span the industry-wide wood replacement blade sales figures were generally trending downwards.

50. The graphical comparison set forth below of Easton's Hybrid Replacement Blade sales vis-a-vis the entire replacement hockey stick blade sales market set forth in the Market Report over the same time-frame is representative measure of the tremendous commercial success of Easton's Hybrid Replacement Blades.

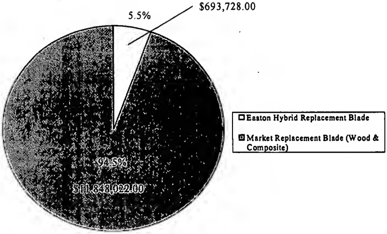
2001



2002



2003



52. Hence, whether Easton's Hybrid Replacement blades are compared with replacement hockey stick market as a whole or vis-à-vis the wood replacement blade market only, which has lost market share over the three years in which Easton's Hybrid Replacement Blades have been on the market, it is clear that Easton's Hybrid Replacement Blades are gaining significant market share in what can only be characterized as highly competitive market.

Accordingly, the direct evidence of applicant's increasing sales of its hybrid hockey stick, *i.e.*, commercial success, in an otherwise level or declining market for directly competing replacement blades, establishes the necessary nexus that the commercial success was predominantly due to the claimed invention. With regard to the objective indicia criterion of "long felt need," both the previously discussed prior art patents ('916 patent to Rodgers and '195 patent to Tiitola et al.) reference the need to retain the industry preference for maintaining the "feel" of traditional wooden sticks while utilizing replacement blades and composite materials.

As the Federal Court has indicated, "evidence of [objective indicia] may often be the most probative and cogent evidence in the record . . . objective indicia may often establish that an invention appearing to have been obvious in light of the prior art was not." *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538-39 (Fed. Cir. 1983); *see Demaco Corp. v. F. Von Langsdorff*

Licensing Ltd., 851 F.2d 1387, 1391 (Fed. Cir. 1988); *Alco Standard Corp. v. Tennessee Valley Auth.*, 808 F.2d 1490, 1500-01 (Fed. Cir. 1986) (affirming trial court finding of nonobviousness based predominantly on evidence of commercial success); *Lindemann Maschinenfabrik GMBH Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1461 (Fed. Cir. 1984) (reversing trial court for failure to consider commercial success even though all other factors indicated invention was obvious). Moreover, when the claimed invention is "simply a variation on known themes " -- as the rejection dated May 1, 2006 claims -- "use of objective indicia is most relevant and persuasive." *Cont'l Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1273 (Fed. Cir. 1991) ("when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider . . . objective indicia . . . in understanding the state of the art at the time the invention was made"). Notably, in the context of an *ex parte* prosecution, the Federal Circuit has instructed the Patent Office "that it must [also] consider objective evidence of nonobviousness – *e.g.* commercial success." *In re Huang*, 100 F.3d 135, 139 (Fed. Cir. 1996) (citing to *In re Sernaker*, 702 F.2d 989 (Fed. Cir. 1983)). Thus, the direct evidence of commercial success that is wholly or predominantly attributable to the claimed invention indicates that the invention is not obvious of the prior art.

Respectfully submitted,

JONES DAY

Dated: June 13, 2007

By: ______________________
Lawrence R. LaPorte
Reg. No. 38,948

555 South Flower Street, 50th Floor
Los Angeles, California 90071
213-489-3939

VIII. CLAIMS APPENDIX

Claim 30. A hybrid hockey stick blade adapted to being removably coupled to a hockey stick shaft comprising:

a composite paddle portion comprising:

i. an elongate member extending from a tip section to a heel section and having a front face and a back face;

ii. the heel section comprising front-side and back-side facing surfaces that are recessed relative to adjacent portions of the front and back faces;

iii. the elongate member further comprising an inner foam core and one or more plies disposed within a hardened resin matrix material overlaying the inner foam core, wherein the one or more plies comprise fibers aligned in one or more defined directions; and

a wooden hosel portion comprising:

i. an adapter member constituted at least in part of wood and extending longitudinally from a first end section to a second end section;

ii. the first end section includes a slot wherein the recessed surfaces of the heel section are received and permanently coupled thereto; and

iii. the second end section being adapted for receipt within a tubular portion of a hockey stick shaft,

wherein a portion of said fibers being interposed between one or more of the recessed heel section surfaces and an overlying inner surface defining the slot in the first end-section of the hosel portion.

Claim 31. The blade of claim 30, wherein at least part of one of the fibers is selected from the group consisting of carbon fiber, aramid, glass, polyethylene, ceramic, boron, quartz, and polyester.

Claim 32. The blade of claim 30, wherein at least part of one of the fibers is selected from the group consisting of carbon fiber, aramid, glass, polyethylene, and ceramic.

Claim 33. The blade of claim 30, wherein at least part of one of the fibers is selected from the group consisting of carbon fiber, aramid, and glass.

Claim 34. The blade of claim 30, wherein at least part of one of the fibers is selected from the group consisting of carbon fiber and aramid.

Claim 35. The blade of claim 30, wherein at least part of one of the fibers comprises carbon fiber.

Claim 36. The blade of claim 30, wherein the recessed front-side and back-side facing surfaces of the heel section are configured to be partially received within the slot of the first end section.

Claim 37. The blade of claim 30, wherein the recessed front-side and back-side facing surfaces of the heel section are configured to be entirely received within the slot of the first end section.

Claim 40. The blade of claim 30 further comprising one or more internal bridge structures disposed within the foam core and extending between the front and back faces.

Claim 42. The blade of claim 40, wherein at least one of the one or more internal bridge structures comprises one or more plies of substantially continuous fibers disposed within a matrix material.

Claim 43. The blade of claim 40, wherein at least one of the one or more internal bridge structure comprises non-continuous fibers disposed within a matrix material.

Claim 44. The blade of claim 30 further comprising one or more internal bridge structures disposed within the foam core and extending between the recessed front-side and back-side facing surfaces of the heel section.

Claim 45. The blade of claim 30 further comprising one or more internal bridge structures disposed within the foam core and extending between the front and back faces of the blade and between the recessed front-side and back-side facing surfaces of the heel section.

Claim 46. The blade of claim 30, wherein the foam core further comprises a top edge and a bottom edge extending between the front face and back face of the blade, wherein at least part of the outer perimeter of the bottom edge or the top edge of the foam is overlaid with a durable edging material.

Claim 47. The blade of claim 46, wherein at least part of the outer perimeter of both the top edge and bottom edge of the foam is overlaid with the durable edging material.

Claim 48. The blade of claim 46, wherein the durable edging material is selected from the group of materials consisting of thermoplastic resins, thermosetting resins, one or more groups of

substantially aligned fibers disposed within either thermoplastic or thermosetting resins, and non-continuous fibers disposed within either thermoplastic or thermosetting resins.

Claim 49. The blade of claim 30, wherein the foam core comprises at least one material selected from the group consisting of polyurethane, PVC, and epoxy.

Claim 108. The blade of claim 30, wherein the foam core is comprised of one or more discrete elements.

Claim 109. The blade of claim 30, wherein the wooden hosel is comprised of wood laminate.

Claim 110. The blade of claim 30, wherein the wooden hosel is comprised of wood laminate overlaid with fiberglass.

IX. EVIDENCE APPENDIX

1. Exhibit A is the "Declaration of Edward M. Goldsmith Pursuant To 37 C.F.R. §1.132" filed May 11, 2005.

2. Exhibit B is US Patent No. 5,303,916 issued on April 19, 1994 to Aubrey Rodgers.

3. Exhibit C is US Patent No. 5,407,195 issued on April 18, 1995 to Tiitola et al.

4. Exhibit D is US Patent No. 6,039,661 issued on August 6, 1997 to Christian et al.

5. Exhibit E is a Memorandum from Margaret A. Focarino, Deputy Commissioner for Patent Operations, dated May 3, 2007.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Continuation Application of:	**Group Art Unit:** 3711
Inventor: Goldsmith, Edward M., et al.	**Examiner:** Mark S. Graham
Serial No.: 10/759,525	
Filed: January 16, 2004	
For: Hockey Stick	
Docket No.: 949797-100029 US	
Customer No.: 34026	

DECLARATION OF EDWARD M. GOLDSMITH PURSUANT TO 37 C.F.R. §1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, **EDWARD M. GOLDSMITH**, declare as follows:

1. I am a citizen of the United States of America, having been born on September 20, 1966 in the State of Georgia. I presently reside in Studio City, California.

2. I am one of two named inventors of U.S. patent application no. 10/759,525 filed on January 16, 2004 (the subject patent application), which is a continuation of U.S. patent application no. 09/663,598 filed on September 15, 2000, each application of which is assigned to Jas. D. Easton, Inc.

CERTIFICATE OF MAILING
(37 C.F.R. §1.10)

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as 'Express Mail Post Office To Addressee' in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

EL 975109173 US	Yolanda G. Ybuan Name of Person Mailing Paper
May 11, 2005 Date of Deposit	Yolanda G. Ybuan Signature of Person Mailing Paper

3. I have a B.A. degree in Economics from Emory University, which I received in May 1988, during which time I played hockey for Emory University.

4. After graduating from Emory University, I coached two semi-pro hockey teams in Europe from 1988 to 1992, while I continued to play hockey.

5. From 1992 to 1996, I was employed by two leading goalie hockey equipment manufacturers. My primary responsibilities during my employment included research and development of new and improved goalie equipment including goalie hockey sticks.

6. Since 1998, I have been and continue to be Vice President of the Hockey Division at Easton Sports, a wholly owned subsidiary of Jas. D. Easton, Inc., a California corporation (collectively referred to herein as "Easton").

7. My responsibilities as Vice President of Hockey include market analysis, research and development of new and improved hockey equipment including hockey sticks and blades, and marketing existing and new hockey equipment products.

8. Prior to becoming Vice President, from about December 1996 to about April 1998, I was employed as an engineer by Easton in the Hockey Division.

9. My primary responsibilities as an engineer at Easton included researching and developing new hockey equipment products including hockey sticks and hockey stick blades.

10. I have played hockey since I was a child in Georgia, during high school in Georgia and college at Emory University. Subsequently, I played hockey while coaching in Europe in Nantes, France and London, England, and I continue to play hockey to this day in El Segundo, California.

11. Easton is in the business of making and selling a variety of hockey equipment including hockey sticks and replacement hockey stick blades and has been in this business for over 25 years.

12. My experiences as hockey player, coach, engineer and Vice President of Easton's Hockey Division has made me intimately familiar with the hockey stick and replacement blade industry.

13. A hockey stick is generally comprised of a blade portion and an elongated shaft portion, which allows the user to manipulate or communicate with the blade during play or use.

14. Early hockey sticks were manufactured by carving a single piece of wood into the desired hockey stick shape. In these early hockey stick constructions, the blade and shaft were seamless unitary extensions of one another. The hockey stick illustrated below is representative of such a construction.

Early Hockey Stick Carved from a Single Piece of Wood

15. Although such unitary hockey stick constructions were thought to promote durability while providing a uniform construction, as described in U.S. Patent No. 1,601,116

issued to Zachariah Adam Hall in 1926 (Attached as **Exhibit A** hereto, hereinafter referred to as "Hall"), the manufacture of such hockey sticks was recognized as producing considerable amounts of waste making them increasingly more expensive to manufacture.

> The object of my invention is to devise a strong, durable and uniformly finished hockey stick that can be inexpensively manufactured and for the construction of which wood can be used that heretofore has been considered factory scrap.
>
> * * *
>
> In the production of a hockey stick from a single piece of wood there is necessarily a considerable amount of waste in the shaping of the handle and blade, and the loss or waste of material in the manufacture is approximately equal to the amount in the manufactured product.

(Hall at p. 1:1-6,15-21).

16. In an attempt to reduce manufacturing costs resultant from the waste described in Hall, the hockey stick industry trended away from such early hockey stick constructions toward the two component constructions disclosed in Hall.

17. Specifically, Hall discloses an all-wood hockey stick in which the shaft and blade are formed as separate wood components and then permanently mated together at a tongue and groove joint with glue and nails.

> The hockey stick comprises two separate parts viz: --a handle shaft 1 and blade 2, with the grain of the wood running lengthwise of each part. By separately making the blade and handle it is possible to use wood of any kind, weight, or texture in the blade and to use a different wood in the handle of the same stick, so that the desired strength and balance may be acquired.
>
> In each of the figures the handle shaft 1 is shown to be formed with a groove or recess 2 extending upwardly into the said shaft from the lower end thereof, and the heel of the blade 3 is formed with a tongue 4 which, when the parts are assembled, is entered in the groove and, for the purpose of making a substantial

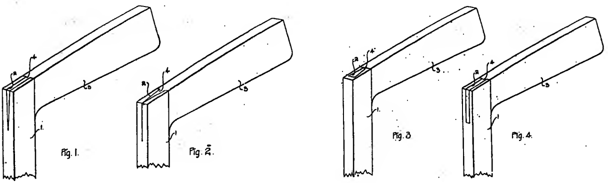
joint between the handle shaft and the blade, is of corresponding shape and dimension to the groove.

* * *

In the preferred construction the handle shaft extends to the sole of the blade and the sides of the groove or mortice tightly embrace the sides of the tongue or tenon and form with it the heel of the stick. The parts are glued together and nailed to form a substantial joint between the blade and the handle shaft.

(Hall at p. 1:77-95 and p.2:20-27).

<u>Figures 1-4 of Hall</u>



(Hall Figs 1-4 (reproduced)).

18. A notable disadvantage of this type of construction, however, is the incorporation of a substantial mechanical joint at the heel of the blade -- the very region of the hockey stick that incurs some of the greatest impact forces during use.

19. This disadvantage was recognized by Hall in his attempt to compensate for the structural weakness associated with placing such a substantial joint in this high impact region.

By this construction the hockey stick will have the same or greater tensile strength than if made of a single piece of wood and the end grain of the wood at the lower extremity of the handle shaft will be presented to the surface of the ice and will protect the heel of the blade from excessive wear and thereby increase the life of the hockey stick.

(Hall at p. 2:27-35).

20. Notwithstanding the disadvantages associated with placing such a substantial joint in a high impact region, the all-wood hockey stick construction disclosed in Hall had the advantage of significantly reducing manufacturing costs while retaining uniformity of the hockey stick in two significant aspects.

(a) First, because the entire front and back faces of the blade including the heel region were entirely formed of wood, no significant disjoint existed between adjacent regions of the blade. In other words, the entire front and back faces of the blade, even at the heel, were each made of wood and as such provided uniformity along the main impact zones of the blade.

(b) Second, because the regions of the blade and shaft that formed the tongue and groove joint were formed of like materials (i.e. wood) having substantially similar physical properties, the joint was less likely to weaken over time and with use.

21. The tongue and groove joint of the all-wood hockey stick construction disclosed in Hall achieved widespread acceptance among hockey players and the hockey stick industry for some time and continues to be employed to this day in the manufacture of "traditional" wood hockey sticks. However, as described in the Background Section of the subject application, such traditional wood sticks, although providing a "feel" that many hockey players prefer or perhaps over the years have become accustomed to, nevertheless continued to have many shortcomings.

22. First and foremost, wood hockey sticks lacked durability often due to fractures in the blade, which frequently occurred at the joint between the blade and the shaft. Thus, frequent replacement was required. This is not surprising given the substantial and sudden impacts received by the blade during the normal course of play (e.g., swinging the blade at high speed at hard vulcanized rubber pucks, slapping the blade on the ice, smashing the blade into or between

the rink boards, goal bars, skates, etc.). Furthermore, due to the variables inherent in wood construction and manufacturing techniques, wood sticks were often difficult to manufacture to consistent tolerances (e.g., the curve and flex of the blade often varied even with the same model and brand of stick). Thus, when the stick was no longer in usable condition, the player was left without a seamless and comfortable replacement. Moreover, because the blade and the shaft were permanently attached to one another, the durability of wood hockey sticks was dependent on the individual durability of each component.

23. As explained in U.S. Patent No. 5,303,916 issued on April 19, 1994 in the name of Aubrey Rodgers (previously cited in the parent application, and attached as **Exhibit B** hereto), in an attempt to improve upon the durability of traditional wooden hockey stick constructions, contemporary hockey stick design -- with the contemporaneous advent of tubular non-wooden hockey stick shafts beginning in the mid-to-late 1970's to early 1980's -- increasingly veered away from the traditional permanently attached blade towards a replaceable blade configuration so that a damaged blade could be readily removed from the shaft and replaced with a new blade:

> Hockey Sticks have traditionally been a one-piece wooden structure. During a typical hockey game, a hockey stick can impact the ice hundreds of times at force levels that often result in fracture or breakage of the stick. Breakage of hockey stick occurs most frequently at the blade portion or at the lower part of the shaft that extends from the blade portion. It is thus fairly common for many hockey players to replace a broken stick at least once during each hockey game.
>
> In an attempt to improve the durability of a hockey stick without sacrificing the characteristics of weight, feel, and flexibility that are desirable in a hockey stick, materials other than wood have been resorted to in constructing hockey sticks. Thus although a wooden hockey stick has set the standard for weight, feel and propulsion of a puck, a new generation of sticks have been formed of plastic and aluminum, as well as laminates of fibrous, plastic and resinous materials. Generally plastic and aluminum provide good strength characteristics for a hockey stick, but the

weight, wear and feel of these materials do not command universal acceptance by hockey players.

Since most hockey players prefer a wooden hockey blade, much attention has been directed to the development of a durable, non-wooden hockey stick shaft that can be used with a wooden blade but is less likely to break than a wooden shaft. One result of such development effort is a hollow aluminum or fibrous hockey stick shaft capable of receiving a replaceable blade that can be formed of wood or plastic.

For example, U.S. Pat. No. 4,086,115 to Sweet et al. [issued April 25, 1978] shows a hollow hockey stick shaft made from graphite fiber and resin. The hockey stick includes a wooden blade with a tongue that engages one end of the hollow shaft and is bonded therein with a polyester resin mixture. It has been found that hollow shafts formed of graphite fiber and resin as disclosed in this patent are more durable than wooden shafts but are still prone to fracture under the usual forces that a stick is subject to in a hockey game.

('916 Patent at Col. 1:14-54).

24. As noted in the '916 patent, initially the tubular shafts were formed of aluminum or fibrous plastics. However, since most hockey players preferred a wooden hockey blade, the blades in these replaceable blade configurations continued to be made of wood.

25. Replacement hockey stick blades are typically comprised of a paddle portion and a hosel portion. The hosel portion extends upward from the paddle portion and includes an upper region that is adapted to being removably connected within the hollow of the lower portion of a tubular hockey stick shaft.

26. In order to retain a uniform hitting surface of the blade while providing a means to connect the blade to the shaft, the hosel on such wood replacement blades was also formed of wood. In this manner, the entire blade maintained a substantially uniform wood construction (even at the heel region) that players had become accustomed to by way of their use of traditional hockey sticks.

27. Also as noted in the '916 patent, while the replaceable blade configuration improved durability of the hockey stick by allowing independent replacement of the blade, the configuration did not overcome the continued lack of durability inherent in such wood blades.

28. In about the late 1980's to early 1990's, in an attempt to improve blade durability, replacement blades -- including those sold by Easton -- began being made of synthetic materials, such as plastic and composites.

29. Because there was no need for such synthetic blades to have a joint at the heel, such synthetic blades were typically formed as unitary synthetic structures that extended from the tip of the blade to the upper portions of the hosel. Hence, the advent of the synthetic replaceable blade effectively made obsolete the need for the traditional tongue and groove joint employed in traditional wood hockey sticks, such as that disclosed in Hall, and subsequently employed in wood replacement blades. It was simply counterintuitive to employ such a joint in a synthetic blade that could readily be formed as a unitary structure since the primary goal of making synthetic blades in the first place was to improve durability.

30. In addition to the added durability gained from removal of the mechanical tongue and groove joint, synthetic blades had many advantageous over wood blade constructions described above and in the Background Section of the subject patent application.

31. Notwithstanding the many advantageous of synthetic replaceable blades, there continued to be a significant number of players that preferred traditional wooden hockey sticks and replaceable blades even though more durable synthetic replaceable blades became increasingly available.

32. As described in U.S. Patent No 5,407,195 issued on April 18, 1995 to Antti-Jussi Tiitola et al. (attached as **Exhibit C** hereto), there was a perception by those of skill in the art

that the continued preference for traditional wooden hockey sticks was due to the failure of synthetic blades to provide physical attributes (e.g., stiffness, flex, weight, etc.) that sufficiently imitated the "feel" of wood blades while retaining the improved durability desired from such blades.

> A blade for a hockey stick must be extremely strong in order for it to indure [sic] the tremendous forces developed between it and a puck. On the other hand, the blade must have a certain amount of flexibility so that the player has an acceptable level of "feel" while handling a puck or executing a shot. The optimum design of a blade furthermore includes a primary concave contact face which places a further limit on its construction; the blade also usually has a corresponding convex contact face which is more or less parallel to the concave face, i.e. in order to keep the weight of the blade low.
>
> Many types of hockey sticks are presently known. Traditional blades for ice hockey sticks are made of one or more pieces (e.g. layers) of wood. A shortcoming of wooden blades is that they are generally not strong enough and thus do not hold up well under the usual conditions encountered when playing hockey. Moreover, labour and material costs for the manufacture of wooden blades are relatively high.
>
> A wooden blade may also be reinforced with fiber (e.g. glass) fabric which is impregnated and bonded to the wooden surface with a synthetic resin. These types of reinforced wooden blades have given good results including good playing performance; This performance is mainly the result of the combination of low weight and high stiffness.
>
> Blades made entirely out of synthetic materials are also known; these include composite blades comprising a fiber (e.g. glass) laminated core (see for example U.S. Pat. Nos. 4,059,269, 4,488,721, 4,591,155, 4,600,192, Finish Pat. No. 65018, etc.) However, difficulties are still encountered in providing a (synthetic) composite blade for a hockey stick that can withstand the substantial impacts to which it is subjected during use yet provide a "feel" comparable to that of traditional wooden sticks when handling the puck and executing a shot. Plastic blades may, for example, have good strength characteristics but may have (high) weight, (low) wear and/or feel (i.e. low stiffness) characteristics which may be unacceptable to some players. It is possible, for example, to obtain a light weight blade having good

> stiffness by using a core of polyurethane foam, but, such a core may have a limited shear strength which may lead to internal fracture of the blade during use.
>
> Accordingly, it would advantageous to have an alternative composite blade construction for a hockey stick or the like which may be strong, durable, light weight and of acceptable stiffness.

('195 patent at Col. 1:19-68).

33. Although, as noted in the '195 patent, the hockey stick industry continued to focus on imitating the "feel" of traditional wood blades using the more durable composite materials, many players nevertheless continued to prefer wood hockey sticks and replaceable blades.

34. I came to the realization that the preference for wooden hockey sticks was perhaps not only a derivative of the fact that the industry had failed to sufficiently "imitate" the "feel" of wood using synthetic materials construction materials, but that the preference may also be derivative of the manner by which the shaft and the blade of traditional wood hockey sticks were joined. In other words, while the industry perceived the preference for traditional wooden hockey sticks as primarily one of materials, I -- contrary to industry perceptions -- perceived the preference not only in terms of materials but also in terms of the manner by which the shaft and blade of traditional wood hockey sticks were mated or joined in such traditional hockey sticks.

35. The result of this realization is embodied in the hybrid hockey stick blade constructions and configurations disclosed in the subject patent application, which was first filed on September 15, 2000.

36. Prior to 2001 there were generally three categories of replacement hockey stick blades -- wood, plastic, and composite. <u>See</u> **Exhibit H** discussed below. The three categories, as previously noted, are descriptive of the primary construction materials of the hosel and paddle. Hence for example the hosel and paddle of a "wood" replacement blade are each substantially constructed of wood or wood laminate and are often overlaid with fiberglass to improve

durability. The hosel and paddle portions of a "plastic" blade are typically formed as a unitary injection molded structure made of PVC or like material. The hosel and paddle portions of a "composite" blade are typically formed of fibers (e.g., carbon, aramid, graphite, etc.) disposed within a hardened resin matrix material or resin overlaying a core structure such as foam or ABS plastic.

37. In about March 2001, Easton first sold its "Hybrid Replacement Blade" product. Easton continues to sell its Hybrid Replacement Blade products to this day.

38. **Exhibits D-G** are color copies of selected pages from Easton's 2001 through 2004 hockey catalogs depicting the various replacement hockey stick blades that were sold by Easton during those years. For each catalog the selected pages include (1) the front and back cover pages, (2) the pages of the catalog that illustrate Easton's replacement blades being sold that year, and (3) a page that includes a table of each replacement blade model and series thereof

39. As described in the catalog pages (**Exhibits D-G**), Easton's Hybrid Replacement Blades are adapted to being removably coupled to a hockey stick shaft. Each Hybrid Replacement Blade comprises a composite paddle portion and a hosel portion constructed of wood. The composite paddle is generally comprised of a foam core overlaid with multiple plies of fibers disposed within a hardened resin matrix. The heel region of the composite paddle is recessed. One end of the hosel portion includes a slot the other is adapted to being received within a tubular portion of a hockey stick shaft. The recessed region of the composite paddle is received within the slot and permanently connected thereto.

40. Easton collects sales data regarding the sales of its own products. Table 1 below summarizes Easton's Hybrid Replacement Blade products described in the attached catalog pages by year and sales figures for each fiscal year, which runs from December 1 to November

30. The sales information for 2004 is only from December 1, 2003 to September 26, 2004, which, together with the cancellation of the NHL 2004-2005 season, explains the drop in sales for 2004.

Table 1: Easton's Hybrid Replacement Blade Models

Fiscal Year	**Hybrid Replacement Blade Models**	**Units Sold**	**Total Revenue in U.S. Dollars**
2001	HYBRID RB	11,979	$178,271
2002	HYBRID PRO JR. HYBRID PRO	43,012	$554,744
2003	HYBRID PRO JR. HYBRID PRO HYBRID SYNTHESIS HYBRID LAMI	49,371	$693,728
2004	HYBRID PRO JR. HYBRID PRO HYBRID SYNTHESIS HYBRID LAMI	40,349	$574,994

41. As will be explained below in reference to the replacement blade market data, these sales reflect substantial year-to-year market gains in a highly competitive replacement blade market.

42. Easton also continually evaluates the replacement blade market. Easton relies on independent parties, such as Rennie Media, Inc., to collect sales data regarding relevant markets and publish its findings.

43. Attached as **Exhibit H** is a color copy of a report entitled "**The U.S. Hockey Stick & Replacement Blade Market Sales for the 2003 Season**" prepared by Rennie Media Inc. Market Research Group (hereinafter "Market Report"), which specifically addresses replacement blade sales data for the U.S. market.

44. As noted on page 1 of the Market Report, the report is specifically formatted to facilitate participating companies to calculate their market share in various stick and blade categories:

> "This report is presented in a format that allows participating companies to calculate their market share in various stick and blade categories. Each company can also compare their average costs with industry-wide averages. And finally, 20003 sales are compared with 2002 sales.

45. Also noted on page 1 of the Market Report is the Methodology and Supplier Participation List, which lists the companies, including Easton, that returned questionnaires that formed the basis for industry wide report embodied in the Market Report. Based on my knowledge of the industry, the participant companies identified in the Market Report constitute the vast majority if not all of the major brands of hockey sticks and replacement blades in the U.S. market.

46. On page 6 of the Market Report is a summary of historical sales figures from 1999 through 2003 of replacement hockey stick blades. See also pages 24-28. This historical sales summary allows Easton—as well as Easton's competitors—to identify market trends related to the products it sells, competitiveness of its products, and the commercial success of its products.

47. The figures in the historical sales summary on page 6 of the Market Report are broken down based on the type or category of blade so as to distinguish composite replacement blade sales from wood and reinforced wood replacement blade sales and from plastic or PVC replacement blade sales. As to the wood blades, there are three sub-categories of wood replacement blades identified in the Market Report: (1) Senior Blades (fiberglass-reinforced

hosel), (2) Senior Blades (hosel not fiberglass reinforced), and (3) Junior Blades (with and without reinforced hosels).

48. A consolidated summary of the three sub-categories of wood versus composite replacement blade sales set forth on page 6 of the Market Report is presented by year in Table 2 below.

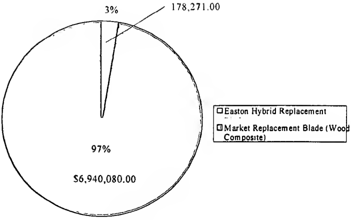
Table 2: Market Summary of Sales of Wood and Composite Replacement Blades

Year	Total Sales of Wood Replacement Blades	Total Sales of Composite Replacement Blade	Total Sales of Composite and Wood Replacement Blades
1999	$11,372,425	$1,811,311	$13,183,735
2000	$10,752,132	$2,710,093	$13,462,225
2001	$5,761,073	$1,179,007	$6,940,080
2002	$8,138,306	$4,235,587	$12,373,893
2003	$5,060,398	$6,787,624	11,848,022

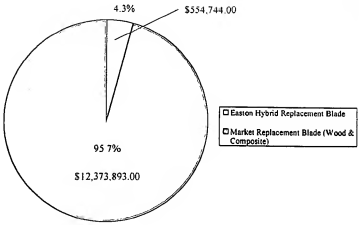
49. Notably, the industry-wide composite replacement blade sales figures during the time-span in which Easton's Hybrid Replacement Blade products were on the market were generally trending upwards while at the same time-span the industry-wide wood replacement blade sales figures were generally trending downwards.

50. The graphical comparison set forth below of Easton's Hybrid Replacement Blade sales vis-a-vis the entire replacement hockey stick blade sales market set forth in the Market Report over the same time-frame is representative measure of the tremendous commercial success of Easton's Hybrid Replacement Blades.

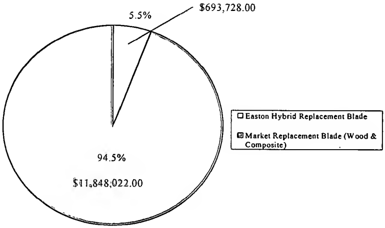
2001



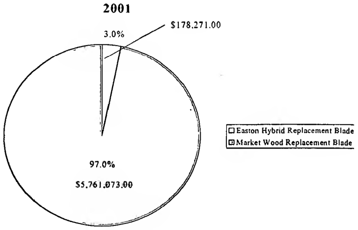
2002

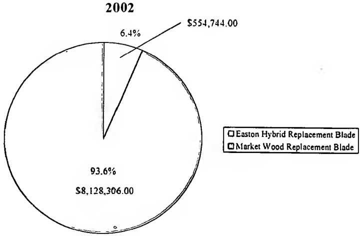


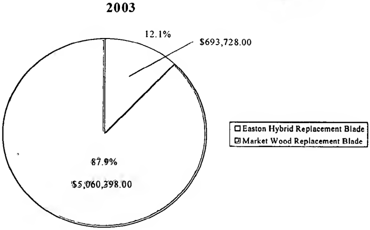
2003



51. The graphical comparison set forth below between Easton's Hybrid Replacement Blade sales vis-a-vis the entire wood replacement hockey stick blade sales market set forth in the Market Report over the same time-frame further illustrates the tremendous commercial success of Easton's Hybrid Replacement Blades







52. Hence, whether Easton's Hybrid Replacement blades are compared with replacement hockey stick market as a whole or vis-à-vis the wood replacement blade market only, which has lost market share over the three years in which Easton's Hybrid Replacement Blades have been on the market, it is clear that Easton's Hybrid Replacement Blades are gaining significant market share in what can only be characterized as highly competitive market.

53. The noticeable gain in market share and commercial success of Easton's Hybrid Replacement Blades, is even more pronounced when taking into consideration the very limited marketing that was expended on these products. Specifically, Easton did not mount any substantial advertisement campaign for the sale of its Hybrid Replacement Blades. In fact, the extent of advertising for Easton's Hybrid Replacement Blades amounted in most part to (1)

placement of the those products in Easton's annual catalogue, which Easton does for most if not all of its Hockey equipment products and (2) seeding of two hundred or so samples of the products with various distributors and players, which Easton does for most if not all of its Hockey equipment products.

54. Moreover, Easton did not engage in any special or unique relationship with retailers for the specific intent of encouraging the sale of Easton's Hybrid Replacement Blades in a manner different from its other hockey equipment products. Rather, Easton's Hybrid Replacement Blades reached retailers through the normal channels of commerce, and without special promotion or pricing.

55. Hence, Easton primarily relied upon word-of-mouth to sell its Hybrid Replacement Blade products.

56. Attached as **Exhibit I** are various trade magazines articles reflecting the recognition in the industry of Easton's Hybrid Replacement Blade products.

57. Thus, not only did the development of Easton's Hybrid Replacement Blades fly in the face of historical industry trends and developments in hockey sticks and replacement blades as set forth above, the significant commercial success of Easton's products constitute yet another compelling indicia of the inventiveness of Easton's Hybrid Replacement Blade products as presently claimed in the subject patent application.

58. I further declare under penalty of perjury that the foregoing statements made herein of my own knowledge are true and correct and that the statements made upon information and belief are believed by me to be true, and further, that these statements were made with the knowledge that willful, false statements and the like are punishable by fine, or imprisonment, or

both, under Section 1001 of Title 10 of the United States Code, and that such willful, false statements may jeopardize the validity of the subject patent application or any issue thereon.

Executed this 11th day of May 2005, at Van Nuys, California, U.S.A.

Edward M. Goldsmith

Sept. 28, 1926. 1,601,116

Z. A. HALL

HOCKEY STICK

Filed Jan. 25, 1926

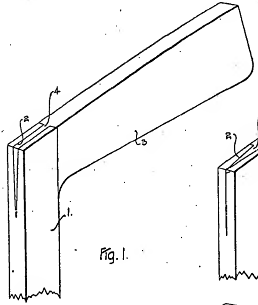


Fig. 1.

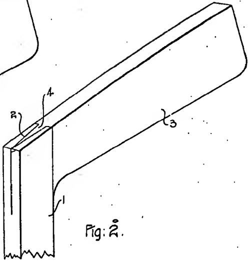


Fig: 2.

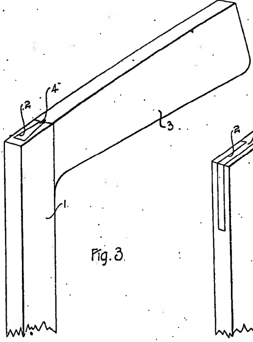


Fig. 3.

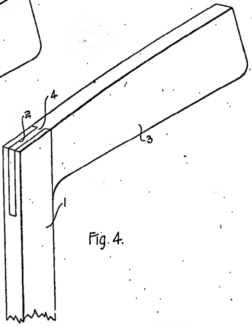


Fig. 4.

Inventor.

Zachariah A. Hall

By

Chas H. Riches

Attorney.

Patented Sept. 28, 1926. **1,601,116**

UNITED STATES PATENT OFFICE.

ZACHARIAH ADAM HALL, OF HESPELER, ONTARIO, CANADA.

HOCKEY STICK.

Application filed January 25, 1926. Serial No. 83,460.

The object of my invention is to devise a strong, durable and uniformly finished hockey stick that can be inexpensively manufactured and for the construction of which wood can be used that heretofore has been considered factory scrap or waste.

This object is attained by separately making the handle and blade, and so jointing them that when the parts are properly assembled the tensile strength and durability of the stick will be at least equal to, if not greater than, the tensile strength and durability of a hockey stick in which the blade is integral with the handle.

In the production of a hockey stick from a single piece of wood there is necessarily a considerable amount of waste in the shaping of the handle and blade, and the loss or waste of material in the manufacture is approximately equal to the amount in the manufactured product. By separately making the blade and handle parts there is practically no waste of material in the shaping of the handle and very little waste of material in the making of the blade, and it is possible to obtain, according to this invention, approximately double the amount of production that can be obtained from the same quantity of raw material when the blade and handle are of an integral nature. By separately making the hockey stick parts it is possible to use for the blade a strong, tenacious material having more or less resiliency or spring and to use a rigid material for the construction of the handle, thereby obtaining the advantage of the full driving force of the stick without risk of breakage under reasonable conditions of use.

In Letters Patent of the United States No. 1,549,971 dated August 18, 1925, and application Serial No. 752,445 filed November 26th, 1924, I have shown and described two methods of carrying out the foregoing objects but my method of construction which forms the subject-matter of this present application still further reduces the cost of manufacturing a stick and effects a still greater saving in material and labor. The subject-matter of the present application consists broadly of a hockey stick comprising a blade and a handle shaft separate from the blade. The handle shaft has at its lower end an inwardly and upwardly extending groove or recess and the heel of the blade has a tongue shaped to fit the groove or recess. This construction permits of the use of a blade, of any width, set at any angle to the handle shaft the specification may call for to meet the special requirement of the individual player.

For a further understanding of my invention reference is to be had to the accompanying drawings, in which:

Fig. 1 is a fragmentary side elevation partly in section of the blade and handle shaft jointed according to my invention,

Fig. 2 is a fragmentary side elevation of a modified form of the construction shown in Fig. 1,

Fig. 3 is a similar view to Fig. 2 showing another modification of the invention, and

Fig. 4 is a similar view to Figs. 2 and 3 showing a further modification.

Like numerals of reference refer to like parts throughout the specification and drawings.

The hockey stick comprises two separate parts, viz:—a handle shaft 1 and blade 2, with the grain of the wood running lengthwise of each part. By separately making the blade and handle it is possible to use wood of any kind, weight, or texture in the blade and to use a different wood in the handle of the same stick, so that the desired strength and balance may be acquired.

In each of the figures the handle shaft 1 is shown to be formed with a groove or recess 2 extending upwardly into the said shaft from the lower end thereof, and the heel of the blade 3 is formed with a tongue 4 which, when the parts are assembled, is entered in the groove and, for the purpose of making a substantial joint between the handle shaft and the blade, is of corresponding shape and dimensions to the groove.

In Fig. 1 the groove or recess 2 extends upwardly into the handle shaft from the lower end, and from the front to the back, thereof and is triangular in cross-section with the apex of the triangle at the top of the groove. The tongue 4, as shown in Fig. 1, is triangular in cross-section and of corresponding dimensions to the groove or recess 2 shown in that figure. When the parts are assembled the tongue is entered in the groove 2 and is glued or otherwise fastened to the handle shaft.

In Fig. 2 the groove or recess 2 extends upwardly into the handle shaft from the lower end, and from the front to the back, thereof and is triangular in cross-section, but in this modification the apex of the triangle is at the

back of the groove instead of at the top as in Fig 1.

In Fig. 3 the handle shaft is shown to be formed with a groove or recess extending upwardly into the handle shaft from the lower end thereof, but in this modification the groove extends only part way from the front to the back edge of the handle shaft and is of a dove-tail shape. The heel of the blade is formed with a dove-tail tongue 4 of corresponding dimensions to the groove 2.

In Fig. 4 the handle shaft 1 is formed with a mortice 2 and the blade 3 is formed with a tenon 4. As shown in this figure of the drawings the mortice 2 extends upwardly into the handle shaft and from the front to the rear thereof, but it may extend only part way through the handle shaft from the front to the rear to receive the tenon.

In the preferred construction the handle shaft extends to the sole of the blade and the sides of the groove or mortice tightly embrace the sides of the tongue or tenon and form with it the heel of the stick. The parts are glued together and nailed to form a substantial joint between the blade and the handle shaft. By this construction the hockey stick will have the same or greater tensile strength than if made of a single piece of wood and the end grain of the wood at the lower extremity of the handle shaft will be presented to the surface of the ice and will protect the heel of the blade from excessive wear and thereby increase the life of the hockey stick.

The term "tongue" used throughout the specification and claims is intended to mean the projecting part of the blade which is shaped to be entered within a corresponding groove of the handle shaft irrespective of the geometric shape of such part, and likewise the term "groove" as used throughout the claims is intended to include in its meaning any recess, socket, mortice or slot corresponding in geometric shape to the tongue.

Having thus fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. A hockey stick comprising a handle shaft having a groove extending into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein.

2. A hockey stick comprising a handle shaft having a groove extending upwardly into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein.

3. A hockey stick comprising a handle shaft having a mortice extending into said shaft at the lower end thereof, and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein.

4. A hockey stick comprising a handle shaft having a mortice extending upwardly into said shaft at the lower end thereof and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein.

5. A hockey stick comprising a handle shaft having a groove extending into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein, the sides of the groove embracing the tongue.

6. A hockey stick comprising a handle shaft having a groove extending into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein, the sides of the groove embracing the tongue from the top of the latter to the sole of the blade and forming with the tongue the heel of the stick.

7. A hockey stick comprising a handle shaft having a groove extending upwardly into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein, the sides of the groove embracing the tongue.

8. A hockey stick comprising a handle shaft having a groove extending upwardly into said shaft at the lower end thereof, in combination with a blade having at its heel a tongue of corresponding shape and dimensions to the groove and entered therein, the sides of the groove embracing the tongue from the top of the latter to the sole of the blade and forming with the tongue the heel of the stick.

9. A hockey stick comprising a handle shaft having a mortice extending into said shaft at the lower end thereof and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein, the sides of the groove embracing the tenon.

10. A hockey stick comprising a handle shaft having a mortice extending into said shaft at the lower end thereof and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein, the sides of the groove embracing the tenon from the top of the latter to the sole of the blade and forming with the tenon the heel of the stick.

11. A hockey stick comprising a handle shaft having a mortice extending upwardly into said shaft at the lower end thereof and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein, the sides of the groove embracing the tenon.

12. A hockey stick comprising a handle shaft having a mortice extending upwardly into said shaft at the lower end thereof and a blade having at its heel a tenon of corresponding dimensions to the mortice and entered therein, the sides of the groove embracing the tenon from the top of the latter to the sole of the blade, and forming with the tenon the heel of the stick.

Dated at the city of Toronto, in the county of York, and Province of Ontario, Dominion of Canada, this 30th day of December, 1925.

ZACHARIAH ADAM HALL.

US005303916A

United States Patent [19]

Rodgers

[11] Patent Number: 5,303,916

[45] Date of Patent: Apr. 19, 1994

[54] HOCKEY STICK SHAFT

[75] Inventor: Aubrey Rodgers, Surrey, Canada

[73] Assignee: Loraney Sports, Inc., New York, N.Y.

[21] Appl. No.: 954,156

[22] Filed: Sep. 30, 1992

[51] Int. Cl.[5] A63B 59/12

[52] U.S. Cl. .... 273/67 A

[58] Field of Search .... 273/67 A, 73 J, 72 R, 273/72 A, 80 R

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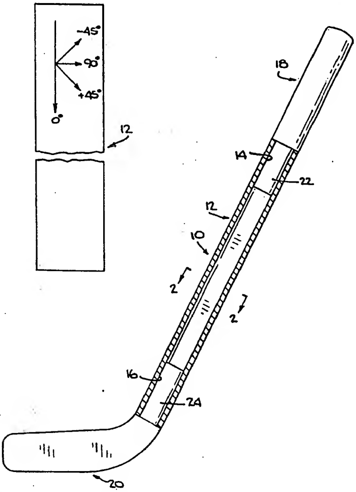
Primary Examiner—Mark S. Graham
Attorney, Agent, or Firm—Rodman & Rodman

[57] ABSTRACT

The improved hockey stick shaft is of elongated tubular configuration, rectangular in cross section, and having opposite open ends. The tubular shaft is formed by pultrusion of a plurality of discrete layers of bondable material including at least one layer of random strand mat glass fibers, at least two layers of 0°/90° balanced plain weave glass fiber fabric, at least two layers of ±45° balanced stitched layered glass fiber fabric, at least one layer of 0° unidirectional carbon fiber roving, and at least one layer of 0° unidirectional glass fiber roving. The layers can be bonded together by a suitable resin, preferably an epoxy resin.

18 Claims, 1 Drawing Sheet



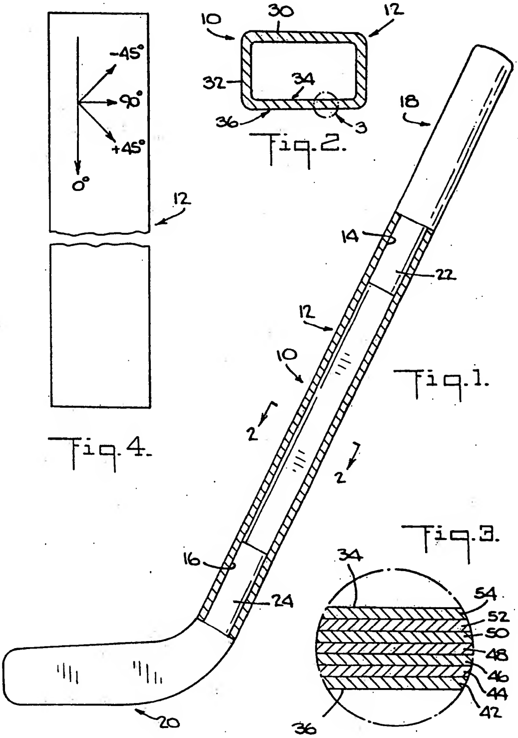


Fig. 4.

Fig. 2.

Fig. 1.

Fig. 3.

HOCKEY STICK SHAFT

BACKGROUND OF THE INVENTION

This invention relates to hockey sticks and more particularly to an improved hockey stick shaft for replaceable hockey blades and handles.

The expanding popularity of hockey at the amateur and professional levels has been fueled by increasing spectator interest in the sport. As a result, there has been a growing demand for hockey equipment, especially hockey sticks.

Hockey sticks have traditionally been a one-piece wooden structure. During a typical hockey game, a hockey stick can impact the ice hundreds of times at force levels that often result in fracture or breakage of the stick. Breakage of a hockey stick occurs most frequently at the blade portion or at the lower part of the shaft that extends from the blade portion. It is thus fairly common for many hockey players to replace a broken stick at least once during each hockey game.

In an attempt to improve the durability of a hockey stick without sacrificing the characteristics of weight, feel, and flexibility that are desirable in a hockey stick, materials other than wood have been resorted to in constructing hockey sticks. Thus, although a wooden hockey stick has set the standard for weight, feel and propulsion of a puck, a new generation of sticks have been formed of plastic and aluminum, as well as laminates of fibrous, plastic and resinous materials. Generally, plastic and aluminum provide good strength characteristics for a hockey stick, but the weight, wear and feel of these materials do not command universal acceptance by hockey players.

Since most hockey players prefer a wooden hockey blade, much attention has been directed to the development of a durable, non-wooden hockey stick shaft that can be used with a wooden blade but is less likely to break than a wooden shaft. One result of such development effort is a hollow aluminum or fibrous hockey stick shaft capable of receiving a replaceable blade that can be formed of wood or plastic.

For example, U.S. Pat. No. 4,086,115 to Sweet, et al. shows a hollow hockey stick shaft made from graphite fiber and resin. The hockey stick includes a wooden blade with a tongue that engages one end of the hollow shaft and is bonded therein with a polyester resin mixture. It has been found that hollow shafts formed of graphite fiber and resin as disclosed in this patent, are more durable than wooden shafts but are still prone to fracture under the usual forces that a stick is subject to in a hockey game.

Thus the problem of shaft breakage or fracture in a hockey stick that includes a hollow shaft, such as disclosed in U.S. Pat. Nos. 4,591,155; 4,600,192; 5,050,878; 4,553,753; 4,361,325; 3,961,790; 4,358,113; 3,934,875 and 4,968,032 ,has been alleviated but not solved since breakage and fracture are still common occurrences even in aluminum or fibrous material hockey stick shafts.

It is thus desirable to provide a hockey stick shaft that is relatively indestructible during a hockey game, permits replaceable use of blades and an end handle, and retains the flexibility and feel commonly associated with a wooden stick.

OBJECTS AND SUMMARY OF THE INVENTION

Among the several objects of the invention may be noted the provision of a novel hockey stick shaft, a novel hockey stick shaft having a greater resistance to breakage and distortion than aluminum or wood shafts, a novel hockey stick shaft which, if broken, does not splinter or produce shards, a novel hockey stick shaft which has the feel of wood, is shock absorbing and flexes but does not bend permanently, and a novel method of improving the torsional strength and fatigue strength of a tubular hockey stick shaft.

Other objects and features of the invention will be in part apparent and in part pointed out hereinafter.

In accordance with the invention, the hockey stick shaft is an elongated tubular member formed as a plurality of discrete layers of bondable material, preferably bonded together by epoxy resin.

In a preferred embodiment of the invention, the hockey stick shaft has a layer sequence from the outside surface to the inside surface of the shaft of,

a) a layer of random strand mat glass fibers,
b) a layer of 0°/90° balanced plain weave glass fiber fabric,
c) a layer of 0° unidirectional glass fiber roving,
d) two layers of ±45° balanced stitched layered unidirectional glass fiber fabric,
e) a layer of 0° unidirectional carbon fiber roving, and
f) a layer of 0°/90° balanced plain weave glass fiber fabric.

The hockey stick shaft is preferably formed by pultrusion and is of substantially uniform wall thickness with opposite open ends adapted to receive a replaceable handle and a replaceable hockey blade.

Under this arrangement, the hockey stick shaft is endowed with torque and twisting strength characteristics that provide good resistance against breakage and distortion, and if broken, the shaft does not produce splinters or shards. The hockey stick shaft is thus non-hazardous in the event of breakage.

The invention accordingly comprises the constructions and method hereinafter described, the scope of the invention being indicated in the claims.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. 1 is a simplified schematic elevation of a hockey stick, partly shown in section, incorporating the shaft of the present invention;

FIG. 2 is a simplified sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary detail of section 3 of FIG. 2, showing the laminate structure of the hockey stick shaft;

FIG. 4 is a simplified schematic of the hockey stick shaft showing the angular direction of the layup materials that constitute the hockey stick shaft.

Corresponding reference characters indicicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

A hockey stick incorporating the present invention is generally indicated by the reference number **10** in FIG. **1**.

The hockey stick 10 includes an elongated tubular shaft member 12 of generally rectangular cross section that is approximately 48 inches long with openings 14 and 16 at opposite ends. The shaft 12, in cross section, has a side 30 approximately 1.2 inches wide and a side 32 approximately 0.8 inches wide. The wall thickness of the shaft 12 is substantially uniform and can vary from about 0.070 to 0.1 inches, preferably about 0.075 to 0.095 inches, and most preferably about 0.080 to 0.085 inches.

A replaceable handle 18 includes a reduced neck portion 22 adapted to fit into the opening 14 of the shaft 12, and a replaceable hockey blade 20 includes a similar reduced neck portion 24 adapted to fit in the opening 16. Preferably, the handle 18 and the blade 20 are made of wood.

The reduced neck portions 22 and 24 of the handle 18 and the blade 20 are coated with a conventional hot melt adhesive, which liquifies when heated and solidifies when cooled and can easily be activated from a convenient source such as a conventional portable hand-held hair dryer. The heat is applied to the shaft 12 at the are of the engaged neck portions 22 and 24, and melts the adhesive to activate the bonding action between the adhesive, the neck portions 22 and 24 and the inside surface 34 of the shaft 12.

Referring to FIG. 3, the shaft 12 includes a layup of discrete layers 42, 44, 46, 48, 50, 52 and 54, which can include unidirectional glass fiber and carbon fiber roving, continuous strand random fiber mat and/or balanced plain weave fiber fabric, and/or stitched layered fabric.

The layup sequence is the stacking sequence of the various fiber orientations in an angular direction that is parallel to the longitudinal axis of the hockey stick shaft. In a pultrusion process, the fiber orientation would be axisymmetric. The layers 42-54, in the layup sequence of FIG. 3 from the outside surface 36 of the shaft 12 to the inside surface 34 are preferably constituted as follows:

1) Layer 42 consists of a single wrapping of a continuous strand glass fiber mat having a random pattern, and whose weight can vary from about 0.5 to 2 ounces per square foot. A suitable continuous strand glass fiber mat is sold under the designation "8641" by Owens Corning Fiberglass Co. The thickness of this layer can vary from about 0.006 to about 0.010 inches, and is preferably about 0.008 inches.
2) Layer 44 consists of a single wrapping of balanced 0°/90° plain weave glass fiber fabric, such as that sold by Mutual Industries, Philadelphia, Pennsylvania under the brand name "Style 2964."The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
3) Layer 46 consists of 0° unidirectional glass fiber roving, known as "continuous roving", such as that sold by Owens Corning Fiberglass Co., Toledo, Ohio. The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
4) Layers 48 and 50 are identical and consist of a single wrapping of balanced ±45° stitched layered glass fiber fabric, such as that sold under the brand name Knytex TM by Hexcel Co., Minneapolis, Minnesota. The thickness of each layer 50 and 48 can vary from about 0.013 to about 0.017 inches, and is preferably about 0.015 inches;
5) Layer 52 consists of 0° unidirectional carbon fiber roving, such as that sold under the brand name Grafil TM Grade 34-700 by Mitsubishi Grafil Co., Sacramento, California. The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
6) Layer 54 is identical to layer 44 and consists of a single wrapping of balanced 0°/90° plain weave glass fiber fabric. The thickness of this layer can vary from about 0.010 to 0.014 inches, and is preferably about 0.012 inches.

Layers 44 and 54 can also each comprise a single wrapping of a balanced 0°/90° stitched layered glass fiber fabric, such as that sold under the brand name Knytex TM by Hexcel Co.

A thin outside surfacing veil (not shown) made of a thermoplastic polyester, such as Nexus TM manufactured by Precision Fabrics Group, Greensboro, North Carolina, is used to provide the outer surface of the shaft with a smooth uniform surface. The surfacing veil is about 0.002 to 0.003 inches thick.

The wall thickness of the hockey stick shaft can vary from about 0.07 to 0.1 inches, preferably about 0.075 to 0.095 inches and most preferably about 0.080 to 0.085 inches. The shaft 12 is preferably made using the technique of pultrusion.

The non-0° materials are fed from rolls of about 3.5 to 4.25 inches wide. The 0° unidirectional carbon fiber rovings can contain about 6000–48000 filaments per roving, and preferably about 24,000 filaments per roving, which are evenly distributed around the entire cross-section of the shaft. The 0° unidirectional glass fiber roving can vary from about 64 yards per pound yield to about 417 yards per pound yield, and most preferably about 247 yards per pound yield.

In the pultrusion production line, the innermost two layers, that is, the 0°/90° glass fiber fabric and the 0° unidirectional carbon fiber roving are fed into a preforming section and impregnated at a first impregnating zone with an epoxy resin, such as Glastic Grade 5227789 , Glastic Corporation, Glastic, Ohio, or Shell Epon TM 828 , Shell Chemical Company.

The resins of choice for impregnating and bonding the layup materials are epoxy resins, which have very low shrinkage during polymerization or curing and also have high strength to failure. Thus, epoxy resins are ideally suited for the preparation of the composite carbon fiber hockey stick shaft.

As the innermost two layers proceed along the production line, the two layers of ±45° glass fiber fabric and the 0° glass fiber roving are added and impregnated with the epoxy resin at a second impregnating zone.

The final 0°/90° glass fiber fabric, the 8641 continuous strand glass fiber mat and the surfacing veil are then added to the production line and fed into a final impregnating zone that surrounds the entire layup production line. The final outside layers are then impregnated with the epoxy resin. On a weight basis, the epoxy resin comprises about 20% to 40%, and preferably about 30 weight % of the hockey stick shaft.

The layup production line is then continuously pulled through a shaped orifice in a heated steel die to give the layup the geometry of the rectangular hockey stick shaft, as seen in FIG. 2. As the materials pass through the die, the epoxy resin and a suitable curing agent, such as methylene diamine or a mixed amine curing agent well known in the art, cures continuously to form a

rigid cured profile corresponding to the hollow rectangular longitudinal shape of the hockey stick shaft.

The layup sequence in the production line is typically pulled through a die that can preferably vary from about 2 to 3 feet in length. The processing temperatures can vary from about 300° to 400° F., preferably about 300° to 320° F., and most preferably about 310° F. along the first half of the die, and preferably about 340° to 360° F., and most preferably about 350° F. along the second half of the die. Typical production line speed can vary from about 6 to 14 inches per minute and preferably about 10 inches per minute.

When the hockey stick 10 is used to hit a puck (not shown), the shaft 12 in reaction has a tendency to twist or be in torsion. The ±45° orientation of the two layers 46 and 48 of ±45° balanced stitched layered glass fiber fabric is believed to provide improved torque and twisting strength to the shaft 12. The additional torque and twisting strength of the shaft 12 provides improved resistance against breakage and distortion.

Another important aspect of the invention is that the 0° unidirectional carbon fiber roving should not be located in the central portion of the layup sequence. It has been found that improved physical properties occur when the 0° carbon fiber roving is located away from the central layer, and is preferably located adjacent to the inside surface or the outside surface of the hockey stick shaft.

The improvement in properties appears due to the fact that when the 0° carbon fiber roving is located in the central portion of the layup sequence, it does not significantly contribute to the overall physical properties of the hockey stick shaft. However, when it is located closer to the outer surface of the layup sequence, improved physical properties occur, particularly in terms of the flexural strength.

Thus, the closer the layer of 0° carbon fiber roving is to the inner or outer surface of the shaft, the more significant will be its contribution to enhanced physical properties, apparently because there is not a uniform stress state in the material. In the central portion there is almost no stress at all because the size of the carbon fiber is not significantly changing when there is bending. Thus, on one side (the outer side), the carbon fiber will stretch, and on the other side (the inner side) the carbon fiber will compress and there is a gradient across from the center line of the roving to the surface.

The closer the carbon fiber roving is to the surface, the greater effect it has in contributing to improved physical properties. The closer it is to the center, the less it will contribute.

Although pultrusion is the preferred method of producing the improved carbon fiber hockey stick shaft, other methods can also be used, such as matched die molding or hand lamination of the multiple layers. The typical improved carbon fiber hockey stick shaft of the present invention has a length of about four feet. However, length can vary in accordance with individual preference. In addition, the layup sequence of materials can also vary.

The following examples are illustrative of the present invention:

EXAMPLE 1

In this example, A, B, C, D and E are each 8 inch wide by 12 inch long flat laminates of separate layup sequences. The materials in each layup sequence are tabulated in Table 1. The physical properties for each layup laminate are tabulated in Table 2. Each line item in the layup sequence is a single discrete layer of material. Each of the 0°/90° FG, 0°FG, 0° CF layers were 0.012 inches thick. The 8641 layer was 0.008 inches thick and the ±45° FG layer was 0.015 inches thick.

The layup was formed by placing one half of the layers (the first four layers in the 8 layer laminates of A, D and E and the first five layers in the 9 layer laminates of B and C) in a mold preheated to 300° F. 135 grams of Glastic 5227789 epoxy resin were poured into the center of the uppermost layer in the mold. The remaining plies were laid on top and 1400 psi pressure from an hydraulic press was then applied for five minutes.

TABLE 1

A	B	C	D	E
8641	8641	8641	8641	8641
0°/90° FG	0° CF	0°/90° FG	0° CF	0° CF
0° FG	±45° FG	±45° FG	±45° FG	45° FG
±45° FG	0°/90° FG	0° FG	0°/90° FG	0°/90° FG
±45° FG	0° FG	0° CF	0°/90° FG	0°/90° FG
0° CF	0°/90° FG	0° FG	±45° FG	±45° FG
0°/90° FG	±45° FG	±45° FG	0° CF	0° FG
8641	0° CF	0°/90° FG	8641	8641
	8641	8641		

TABLE 2

Layup Sequence	A	B	C	D	E
Tensile Strength (psi)	84,060	101,000	64,740	100,200	44,430
Tensile Modulus (psi × 10^{-6})	9.76	11.5	6.9	10.3	2.65
Flex Strength (psi)	66,410	78,890	54,260	78,060	71,890
Flex Modulus (psi × 10^{-6})	3.89	10.21	3.16	9.68	2.66
Notched Izod (ft.-lb./in.)	33.8	38.9	33.1	30.8	43.6

As seen from Table 1 and Table 2, the various configurations in the layup sequence can be changed to achieve the balance of properties desired by the user to achieve desired flexibility, stiffness (flex modulus) and strength (tensile strength).

It was observed that carbon fibers closer to the surface gave better physical properties. The highest impact strength (notched Izod) resulted with an all-glass fiber layup (E). There was a higher modulus with carbon than with glass fiber.

EXAMPLE 2

A fifteen year old Canadian hockey player used a number of different hockey sticks over a two-day period, including two prototypes of the inventive hockey stick shaft. The sticks were used to hit a standard National Hockey League hockey puck several times over a smooth ice surface on a day when the temperature was about 55°. The average speed of the puck was measured by a Sports-Star SL-300 hand held radar gun manufactured by Sports-Star Co. of Portland Oregon. There were appropriate rest intervals and stick rotation.

The average speed was calculated on the basis of 10 shots per day with each hockey stick, eliminating the highest and lowest speeds. The test results are tabulated in Table 3.

TABLE 3

HOCKEY STICK MODEL	AVERAGE SPEED (M.P.H.) DAY 1	DAY 2
1. EASTON STIFF FLEX[a] HXP 4900 GOLD	67.37	68.25
2. EASTON W/CARBON FIBER[a] HX A/C 7100 EXTRA STIFF	66.38	68.00
3. EASTON GRETZKY[a] EXTRA STIFF HXP 5100	70.38	70.50
4. SHERWOOD PMP 7000[b] AL MACINNIS MODEL	70.50	70.75
5. CAMAXX EXTRA STIFF[c] SCR 2000	72.37	71.87
6. CAMAXX STIFF FLEX[c] SCR 1000	74.25	74.62

[a]Easton Sports, Inc., Burlingame, California
[b]Sherwood Drolet Ltd., Sherbrooke, Canada
[c]Prototype of the invention. The layup sequence is as described in the aforesaid description of FIG. 3, with each layer having the preferred thickness. There were 10% more carbon fiber filaments in the SCR 2000 than the SCR 1000 hockey stick shaft. Additional resin replaced the reduced amount of carbon fiber roving in the SCR 1000 hockey stick shaft.

Some advantages of the inventive carbon fiber hockey stick shaft are as follows:

1) 20% lighter than aluminum;
2) Stronger than aluminum and wood;
3) Flexes well but does not bend permanently;
4) Feels like wood as compared to aluminum;
5) Has a much better gripping surface than aluminum;
6) No vibrations —aluminum has tremendous vibrations and needs styrofoam for stabilization;
7) The blade can be installed and removed with a heat gun rather than a blow torch and is thus safer to use and more convenient;
8) There is efficient removal of the blade or handle;
9) Cost is comparable to aluminum;
10) Has high capacity manufacturing capability without production problems;
11) The stick shoots harder and faster than either wood or aluminum;
12) Color will not chip;
13) There is a minimal fatigue factor in comparison with aluminum. Thus the stick retains accuracy throughout its life;
14) It is more durable and economical because there is minimal fatigue or breakage;
15) It is safer than wood or aluminum and there are no splinters or shards. If the stick breaks, there is a benign fracture;
16) Blades last longer because the shaft absorbs the impact.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes can be made in the above constructions and method without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A hockey stick shaft comprising,

a) an elongated tubular member of generally rectangular cross section having opposite open ends, an inside surface, and an outside surface,

b) said tubular member being formed as a plurality of discrete layers of bondable material in a layup comprising:

(i) at least one layer of random strand mat glass fibers,

(ii) at least two layers of glass fiber material selected from the group consisting of 0°/90° balanced plain weave glass fiber fabric, 0°/90° stitched layered glass fiber fabric, and mixtures thereof;

(iii) at least two layers of ±45° balanced stitched layered glass fiber fabric,

(iv) at least one layer of 0° unidirectional carbon fiber roving,

(v) at least one layer of 0° unidirectional glass fiber roving, wherein said layers are bonded together by a resin.

2. The hockey stick shaft as claimed in claim 1, wherein the resin is an epoxy resin.

3. The hockey stick shaft as claimed in claim 1 having the following sequence of layers in a direction from the outside surface to the inside surface of said shaft,

a) a layer of said random strand mat glass fibers,

b) a layer of said 0°/90° balanced plain weave glass fiber fabric,

c) a layer of said 0° unidirectional glass fiber roving,

d) two layers of said ±45° balanced stitched layered unidirectional glass fiber fabric,

e) a layer of said 0° unidirectional carbon fiber roving,

f) a layer of said 0°/90° balanced plain weave glass fiber fabric,

wherein the layer of said random strand mat glass fiber forms the outside surface of said tubular member and said other layers are the intervening layers in the sequence indicated.

4. The hockey stick shaft as claimed in claim 1, wherein said tubular member is of substantially uniform wall thickness.

5. The hockey stick shaft as claimed in claim 1, wherein one of the opposite open ends is adapted to receive a replaceable handle and the opposite open end is adapted to receive a replaceable hockey blade.

6. The hockey stick shaft as claimed in claim 1, wherein the fiber orientations are measured from an angular direction that is parallel to the longitudinal axis of the hockey stick shaft.

7. The hockey stick shaft as claimed in claim 1, further including an outside surfacing veil of thermoplastic polyester.

8. The hockey stick shaft as claimed in claim 7, wherein the surfacing veil has a thickness range of about 0.002 to 0.003 inches.

9. The hockey stick shaft as claimed in claim 4, wherein the wall thickness of the tubular member is in the range of about 0.07 to 0.1 inches.

10. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of random strand mat glass fibers is in the range of about 0.006 to 0.010 inches.

11. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0°/90° fiber is in the range of about 0.010 to 0.014 inches.

12. The hockey stick shaft as claimed in claim 1, wherein the thickness of each layer of ±45° balanced stitched layered glass fiber fabric is in the range of about 0.013 to 0.017 inches.

13. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0° unidirectional glass fiber roving is in the range of about 0.010 to 0.014 inches.

14. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0° unidirectional carbon fiber roving is in the range of about 0.010 to 0.014 inches.

15. In an elongated hollow tubular composite hockey stick shaft formed from a plurality of discrete layers of layup material selected from the group consisting of glass fiber mat, glass fiber roving, carbon fiber roving, woven fabric, stitched layered fabric and mixtures thereof, the improvement which comprises including in the layup sequence

(a) at least one layer of ±45° balanced plain weave glass fiber fabric at a central portion of the layup sequence;

(b) at least one layer of 0° unidirectional carbon fiber roving located away from the central portion of the layup sequence;

(c) at least one layer of 0° unidirectional glass fiber adjacent the layer of ±45° balanced plain weave glass fiber fabric and

(d) at least one layer of 0°/90° glass fiber fabric adjacent the layer of 0° unidirectional carbon fiber roving.

16. A method of improving the torsion strength and fatigue strength of a tubular hockey stick shaft comprising,

(a) forming a layup of:

(i) at least one layer of random strand mat glass fibers,

(ii) at least two layers of glass fiber material selected from the group consisting of 0°/90° balanced plain weave glass fiber fabric, 0°/90° stitched layered glass fiber fabric, and mixture thereof;

(iii) at least two layers of ±45° balanced stitched layered glass fiber fabric,

(iv) at least one layer of 0° unidirectional carbon fiber roving,

(v) at least one layer of 0° unidirectional glass fiber roving, and

(b) bonding said layers of the layup together with a resin at a temperature varying from about 300° to 400° F.

17. The method of claim 16, including using an epoxy resin in the bonding step.

18. The method of claim 16 including of sequencing the layers that form the layup in a direction from the outside surface of the tubular shaft to the inside surface of the tubular shaft in he following order:

a) positioning a layer of said random strand mat glass fibers as the outermost layer of the tubular shaft,

b) positioning a layer of said 0°/90° balanced plain weave glass fiber fabric adjacent the layer of said random strand mat glass fibers,

c) positioning a layer of said 0° unidirectional glass fiber roving adjacent the layer of said balanced plain weave glass fiber fabric,

d) positioning two layer of said ±45° balanced stitched layered unidirectional glass fiber fabric adjacent the layer of said 0° unidirectional glass fiber roving,

e) positioning a layer of said 0° unidirectional carbon fiber roving adjacent said layers of ±45° balanced stitched layered unidirectional glass fiber fabric,

f) positioning a layer of said 0°/90° balanced plain weave glass fiber fabric adjacent said layer of 0° unidirectional carbon fiber roving,

wherein the layer of said random strand mat glass fiber is the outermost layer of said tubular shaft and said other layers are the intervening layers in the sequence indicated.

* * * * *

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United States Patent [19]

Tiitola et al.

[11] Patent Number: 5,407,195

[45] Date of Patent: Apr. 18, 1995

[54] BLADE CONSTRUCT FOR A HOCKEY STICK OR THE LIKE

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[73] Assignee: K.C.G. Hockey Finland Oy, Forssa, Finland

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[22] Filed: Oct. 6, 1992

[51] Int. Cl.^{6} A63B 59/12
[52] U.S. Cl. .... 273/67 A
[58] Field of Search .... 273/67 A, 735, 167 H, 273/67 R; 156/78

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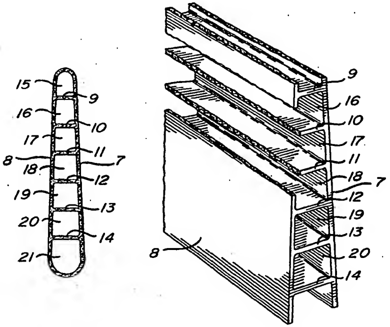
Attorney, Agent, or Firm—Fay, Sharpe, Beall, Fagan, Minnich & McKee

[57] ABSTRACT

The present invention relates to a blade construct for a hockey stick or the like. The blade construct has a blade body comprising a first face member, and a second opposed face member. The first and second face members are spaced apart and are of fiber reinforced plastics material. The blade construct is characterized in that, a core cavity member is sandwiched between the first and second face members. The core cavity member comprises one or more bridge members of fiber reinforced plastics material. The first face member, the second face member and the bridge members are integral, and one or more of the bridge members comprises a fiber reinforcing component oriented transversely with respect to the first and second face members.

31 Claims, 4 Drawing Sheets



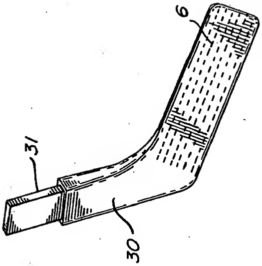


FIG. 12

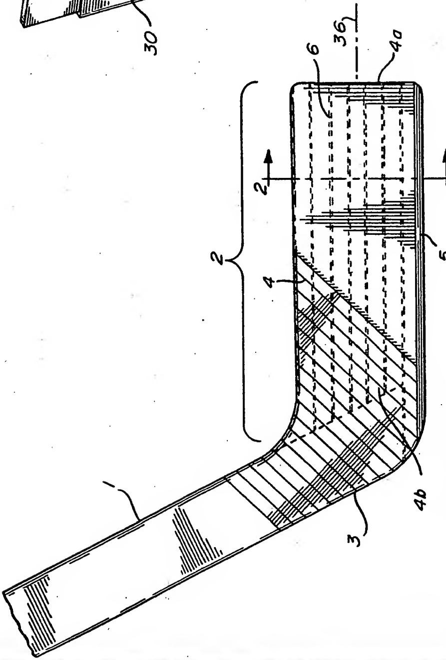


FIG. 1

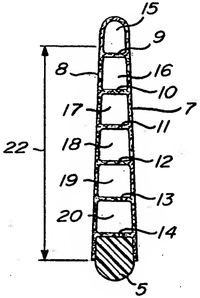


FIG. 2

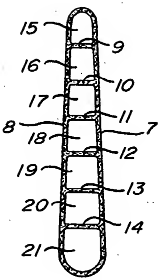


FIG. 3

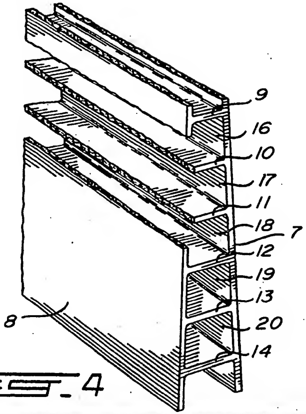


FIG. 4

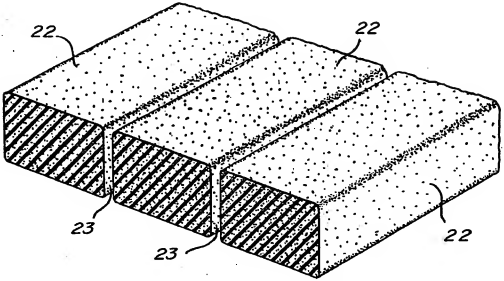


FIG. 5

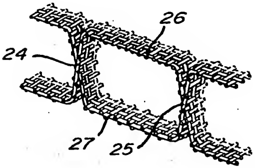


FIG. 6

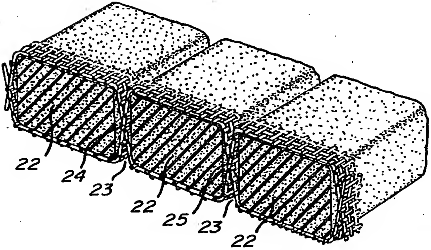


FIG. 7

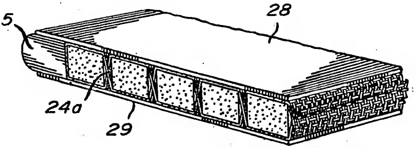


FIG. 8

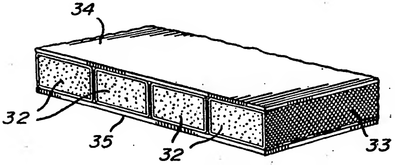


FIG. 9

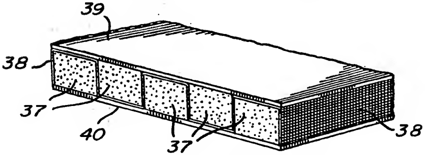


FIG. 10

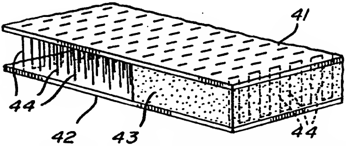


FIG. 11

BLADE CONSTRUCT FOR A HOCKEY STICK OR THE LIKE

FIELD OF THE PRESENT INVENTION

The present invention relates to game stick blades and in particular to a composite blade construction for use with hockey sticks or the like; such sticks include, for example, ice hockey sticks (including goalie sticks), street hockey sticks and the like. The present invention, by way of example only, will be described hereinafter in relation to an ice hockey stick.

DESCRIPTION OF PRIOR ART

Ice hockey sticks generally consist of two basic elements, namely an elongated handle component and a blade secured to the lower end of the handle.

A blade of a hockey stick must be extremely strong in order for it to indure the tremendous forces developed between it and a puck. On the other hand, the blade must have a certain amount of flexibility so that the player has an acceptable level of "feel" while handling a puck or executing a shot. The optimum design of a blade furthermore includes a primary concave contact face which places a further limit on its construction; the blade also usually has a corresponding convex contact face which is more or less parallel to the concave face, i.e. in order to keep the weight of the blade low.

Many types of hockey sticks are presently known.

Traditional blades for ice hockey sticks are made of one or more pieces (e.g. layers) of wood. A shortcoming of wooden blades is that they are generally not strong enough and thus do not hold up well under the usual conditions encountered when playing hockey. Moreover, labour and material costs for the manufacture of wooden blades are relatively high.

A wooden blade may also be reinforced with fiber (e.g. glass) fabric which is impregnated and bonded to the wooden surface with a synthetic resin. These types of reinforced wooden blades have given good results including good playing performance; this performance is mainly the result of the combination of low weight and high stiffness.

Blades made entirely out of synthetic materials are also known; these include composite blades comprising a fiber (e.g. glass) laminated core (see for example U.S. Pat. Nos. 4,059,269, 4,488,721, 4,591,155, 4,600,192, Finnish Pat. No. 65018, etc.). However, difficulties are still encountered in providing a (synthetic) composite blade for a hockey stick that can withstand the substantial impacts to which it is subjected during use and yet provide a "feel" comparable to that of traditional wooden sticks when handling the puck and executing a shot. Plastic blades may, for example, have good strength characteristics but may have (high) weight, (low) wear and/or feel (i.e. low stiffness) characteristics which may be unacceptable to some players. It is possible, for example, to obtain a light weight blade having good stiffness by using a core of polyurethane foam, but, such a core may have a limited shear strength which may lead to internal fracture of the blade during use.

Accordingly, it would be advantageous to have an alternative composite blade construction for a hockey stick or the like which may be strong, durable, lightweight and of acceptable stiffness.

SUMMARY OF THE INVENTION

Generally, in accordance with the present invention, there is provided a blade element of composite construction which has a three dimensional fibre reinforcement structure, i.e. fiber reinforcement is oriented transversely between the (puck contact) face members such that the fiber reinforcement of the face members and those fibers transverse thereto form a three dimensional fiber reinforcement array embedded in a (suitable) resin matrix structure. Thus, the body of a blade element of the present invention may comprises a first face member and second opposed face member, both of fiber reinforced plastics material. These face members may be connected to each other by means of bridge or pillar members also of fiber reinforced plastics material, the bridge members being part of a core cavity member sandwiched between the face members. A transverse fiber component of the reinforcing fiber element of one or more of such bridge members contributes to the strength and stiffness of the construction. A blade element of such configuration may provide a durable structure while at the same time providing a player with the proper "feel" in handling the puck.

Accordingly, in a general aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said face members,

said core cavity member comprises one or more bridge members of fiber reinforced plastics material,

said first face member, said second face member and said bridge members are integral, and

one or more of said bridge meters comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with the present invention, the blade construct may, for example, have a plurality of bridge members. Thus, a blade construct may have a plurality of bridge members, one or more of which comprises a fiber reinforcing component oriented transversely with respect to the first and second face members. In accordance with the present invention, a blade construct may, in particular, have a plurality of bridge members, each of which comprises a fiber reinforcing component oriented transversely with respect to the first and second face members.

In accordance with the present invention, the weight (e.g. lightness) of the blade construct may vary as a function of the extent and structure of the core cavity member sandwiched between the opposed face members; i.e. the core cavity member may contribute to the lightness thereof. The core cavity member (apart from the bridge members thereof) may, for example, have a hollow (i.e. empty) aspect; alternatively, it may be filed with some lightweight material (e.g. a plastics foam material or the like) which may or may not, as desired, contribute to the structural integrity of the blade construct and which may or may not be integral with the bridge or face members. The core cavity member may, for example, comprise a pocket or a plurality of pockets

which may be discrete or be interconnected in any desired fashion. The core cavity member may alternately comprise, for example, a plurality of (microspherical) hollows present so as to reduce the specific gravity of the construct. As used herein the expression "core cavity member" is to be understood as including the above aspects.

In accordance with the present invention, the strength of the blade construct will, inter alia, depend on the core cavity bridge members which are integral with the face members (e.g. glued thereto, formed integral thereto, etc.). The number of bridge members, the blade volume occupied by the core cavity member (e.g. the pocket(s) or hollows as mentioned above), the blade volume of the bridge members, the number of any pockets, etc. may be varied, as desired, in any suitable (known) manner, in accordance with the resin-fiber material and structure desired to be used for the face and bridge members. However, the configuration and structure of the bridge member(s), connecting the face members together, must be such as to adequately maintain the structural integrity of the blade construct in light of the ultimate environment of use of the blade.

With the above in mind, a core cavity member may take on any configuration whatsoever. As a consequence, the bridge members may, similarly, also take on any configuration (e.g. be post-like, rib-like, etc, in configuration) or orientation (e.g. perpendicular, angled, etc.) between the first and second face members.

A bridge member may, for example, have a rib-like aspect. A rib bridge member may extend longitudinally of the blade construct; the word "longitudinally" is to be understood herein as characterizing a rib bridge member as being oriented such that the ends thereof are directed more or less towards the tip and heel regions of the blade as against being oriented towards the top and bottom of the blade, the bottom of the blade being the part thereof intended to ride along a (ice) surface. A rib bridge member may extend more or less the entire length of the blade (i.e. from about the tip region of the blade construct to about the heel region of the blade construct) or it may be of some intermediate length and be disposed therebetween. A rib bridge member may have a straight or curved aspect. A rib bridge member may extend longitudinally more or less parallel to the (effective) longitudinal axis of the blade construct; a rib bridge member may, however, if desired, extend at an angle to the longitudinal axis.

A blade construct may have one or more of such rib bridge members.

Thus, in accordance with a particular aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

- a first face member, and
- a second opposed face member,
- said first and second face members being spaced apart and being of fiber reinforced plastics material,
- characterized in that,
- a core cavity member is sandwiched between said first and second face members,
- said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,
- said rib bridge members extend longitudinally of said blade body,
- said first face member, said second face member and said rib bridge members are integral, and
- one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

As mentioned above, a core cavity member may take on any configuration whatsoever keeping in mind the above referred to aspects thereof. Accordingly, a core cavity member may comprise a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows (e.g. microhollows) so as to provide the core cavity member with a cellular structure. The hollows may be present in a size and number sufficient to provide the blade construct with the desired specific gravity, strength, etc. In this case, the bridge member of the core cavity member may comprise a single integral bridge body element having included within its structure the hollows as well as the transversally disposed fiber reinforcing component. Apart from the transverse members, the core cavity member may in this case include a fiber reinforcing component oriented more or less parallel to the face members of the blade.

Thus, in accordance with an additional aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

- a first face member, and
- a second opposed face member,
- said first and second face members being spaced apart and being of fiber reinforced plastics material,
- characterized in that,
- a core cavity member is sandwiched between said first and second face members,
- said core cavity member comprises a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows so as to provide the core cavity member with a cellular structure,
- said first face member, said second face member and said bridge body are integral, and
- said bridge body comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with the present invention the expressions "fiber component which is oriented transversely", "transverse fiber component" and the like are to be understood as referring to a non-parallel orientation (relative to the face members) of fiber component, i.e. the spatial disposition of such fiber component is such that the fiber component (i.e. a length dimension) is in a non-parallel relation with respect to the face members. The transverse fiber component may of course be one component of a fiber reinforcement element embedded in the resin matrix of a bridge member; other fiber component(s) may be disposed in different fashion i.e. in a more or less parallel fashion with respect to the face members. A bridge member and/or transverse fiber component thereof may, for example, be Oriented so as to provide, when the blade construct is viewed in cross-section, an aspect which is more or less perpendicular to the face members or some other angled aspect such as for example an aspect which includes a 45 degree angle.

In accordance with the present invention, a fiber reinforcing element of a bridge member may be disposed solely in the body of the bridge member. Alternatively a component of a fiber reinforcing element of a bridge member may merge with or be connected to the fiber reinforcement element of one or both face members. Thus a fiber reinforcing element of a bridge member may, for example, have a fiber component (or components) which is (are) connected at one end thereof to

the transverse fiber reinforcement component while the other end of such coupler fiber component extends into the resin matrix of a face member, such end extension thus forming a component of the fiber reinforcement element of such respective face member. The fiber reinforcing element of a bridge member may, for example, comprise a part of a single continuous fiber body which includes all or part of the fiber reinforcing elements of the face members, i.e. the transverse fiber reinforcing component of a bridge member is connected to the fiber reinforcing elements of both face members. Accordingly, the word "connect(ed)" or the like (in relation to the transverse component) is to be understood herein in the context of such combinations.

Depending on the nature of the starting fiber material desired to be used to make the fiber reinforced composite blade construct, it may prove necessary, in order to obtain a desirable transverse orientation of a fiber component:, to subject the fiber reinforcement material of the intended bridge member to some degree of tension during curing (i.e. of the resin). The underlying purpose of maintaining some degree of tension or stretching during curing is to inhibit such fiber component from being embedded in the resin matrix in a collapsed or folded state; accordingly the degree of tension on the embedded fiber component to accomplish this purpose may be so negligible as to constitute no tension at all. However, it may be desired to provide significant tension to a fiber component of an intended bridge member in order to have a tensioned fiber reinforcing component which is oriented transversely to the face members; i.e. to obtain a sort of prestressed bridge member analogous to a prestressed rod reinforced concrete body wherein the rods are maintained under tension during curing of the concrete matrix. Accordingly, as used herein the words "tension", "tensioned", or the like, are to be understood as characterizing a fiber reinforcing element (which is embedded in a resin matrix), as having been subjected to a degree of tension during curing of the initial fiber/resin combination, the degree of tension being predetermined in light of the above.

The blade construct, of the present invention, may, for example, be incorporated into a replaceable blade section. The replaceable blade section may be provided with a spigot member for releasable, mating engagement with a slot in one end of a handle section; if desired the blade section may have such a slot for similar engagement with a spigot at the end of a handle section; see, for example, U.S. Pat. Nos. 4,600,192, 4,488,721, 4,358,113 and 3,934,875 which show such spigot/slot type engagement means (the entire contents of these patents are incorporated herein by reference). Alternatively, the blade construct may be integrally attached to a handle in any suitable (known) manner; for example the blade construct when formed may be directly fixed to the handle by fiber-reinforce plastics material (see for example U.S. Pat. Nos. 4,591,155 and 4,059,269, the entire contents of which are incorporated herein by reference). The handle section itself may take any suitable (known) form or configuration.

Thus, in accordance with a particular aspect of the present invention there is provided a hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and
a second opposed face member,
said first and second face members being spaced apart and being of fiber reinforced plastics material,
characterized in that,
a core cavity member is sandwiched between said first and second face members,
said core cavity member comprises one or more bridge members of fiber reinforced plastics material,
said first face member, said second face member and said bridge members are integral, and
one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with a further particular aspect the present invention provides a hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and
a second opposed face member,
said first and second face members being spaced apart and being of fiber reinforced plastics material,
characterized in that,
a core cavity member is sandwiched between said first and second face members,
said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,
said rib bridge members extend longitudinally of said blade,
said first face member, said second face member and said rib bridge members are integral, and
each said rib bridge member comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

According to the present invention, the blade construct may be made in any suitable manner, whatsoever, provided that the necessary core cavity bridge structure is achieved for connecting the face members together. If desired a shaft may be secured to the blade construct by suitable resin impregnated fiber reinforcing plastics layers extending from the face members and the obtained green combination cured in a press mold to form the desired hockey stick.

In accordance with the present invention the fiber reinforced plastics material of the face and bridge members may be composed of a suitable (known) resin and a suitable (known) fiber reinforcement element; the resin may, for example, be a polyester or epoxy resin while the fiber reinforcement element may, for example, be of glass fibers, carbon fibers, organic (polyamide) fibers, etc. A fiber reinforcement element which may be used in the context of the present invention may take any suitable (known) form, such as, for example, fiber strands, a fabric (e.g. a woven or non-woven fabric), etc.

In accordance with the present invention the face members may be built up in any suitable (known) manner from resin and fiber reinforcement elements keeping in mind, however, the stress, shock, etc., to which they will be subjected during use. The fiber element may comprise one or more fiber (mat) layers.

The blade construct may, for example, be built up using a suitable preform which makes allowance for the formation of the required core cavity bridge structure.

If bridge members having the aspect of a plurality of longitudinally extending ribs are desired, a rib preform may, for example, comprise a channelled fabric of reinforcing fibers wherein interconnected fabric channels are disposed about suitable elongated support or filler members, the filler members being configured to tend to

maintain fibers of each channel disposed between adjacent filler members in a (tensioned) transverse orientation during the curing and shaping stage of the fabrication process i.e. transverse relative to the face members of the final product.

A reinforcing fabric for such a rib preform may, for example, comprise reinforcing fibers or fiber strands woven into a two layered channelled fabric; the warps of the two layers of fabric criss-crossing each other forming fabric channels between a pair of cross-over points.

The interconnected fabric channels of such a rib preform may be filled with flexible foam stripes of plastics material, thermoplastic rigid foam stripes, (removable) thin walled pressure hoses, etc.; e.g. strips of polyurethane foam, one or more slabs of polyurethane foam, etc. Under the desired curing conditions, a flexible or thermoplastic rigid foam must facilitate imparting to the blade construct, the shape and thickness of the mold form; e.g. a thermoplastic foam should soften at the mold temperatures used. If the channels are filled with pressure hoses these have to be able to be (de)pressurised during the molding operation so that the blade construct takes the thickness and shape of the mold.

Filler members may be disposed in the fabric channels during the weaving of the two layered fabric or can be disposed therein thereafter.

The channelled fabric for the above mentioned rib preform may be pre-impregnated with a suitable resin such as an epoxy resin or the like. The resin in the cross-over fabric region between adjacent filler members is intended-, once cured, to have imbedded therein a transverse fibre reinforcing component; i.e. in the cured hardened state this portion of the resin defines a resin matrix for the core cavity bridge members of the present invention which connect the face members together.

The above described rib preform, comprising the channelled fabric, the filler members and resin may be moulded into a hockey stick blade of the desired shape and thickness, any necessary or desired additional layers of resin impregnated reinforcing fabric being previously added to both of the opposed faces thereof.

After curing the reinforcing fabric elements and resin between the filler members form a composite bridge structure holding the spaced opposed face members together; the rib bridge members have a reinforcing fiber component extending therethrough transverse to the face members.

Instead of interconnected fabric channels a plurality of independent fabric covered foam strips may for example be used to make a rib preform. Thus stripes of flexible foam plastic, thermoplastic rigid foam or thin walled pressure hoses may be covered with a sock type of reinforcing fiber fabric. The weave of the fabric sock can be such that the webs thereof run in a controlled angle with respect to the longitudinal axis of the strip(s). For instance they may be at a 45 degree angle so as to enhance shear stress resistance. Several of these "sausages" type members, (the fabric thereof impregnated with a suitable resin) may be lain side by side sandwiched between outer layers of resin impregnated fabric and cured in a mold as mentioned above to provide a blade construct having core cavity rib bridge members.

Alternatively a rib preform may be constructed from several stripes of rigid foam which can be either preshaped or thermoplastic. A preimpregnated layer of reinforcing fiber fabric or mat may be lain about the strips in intertwining fashion so that the fabric runs along the first outer surface of a first strip, between the first strip and an adjacent second strip, over the second outer surface of the second strip, between the second stripe and a third stripe, along the first outer surface of the third strip and so on. The rest of the above example methodology may then be followed.

In accordance with a further possible preform structure, layers of reinforcing fiber fabric or mat may be knitted together with a plurality of reinforcing fiber thread or strands which run through both layers and which have a certain length such that the layers may be held apart from each other with a suitable springy distance holding member such as mentioned above; i.e. the knitting is loose enough to allow the layers to be spaced apart a certain distance. This three dimensional preform may then be placed into a mold which is filled with expanding polyurethane or epoxy resin, etc.

The joining of the blade construct to a hockey shaft or the like may take place in known fashion (see for example U.S. Pat. No. 4,059,269). Thus, for example resin impregnated fiber fabric may be disposed over each of the opposed face surfaces of a preform so as to provide flap portions which may extend over the tapered lower end of a hockey shaft, the end being configured to define part of the heel end of the intended blade. Thereafter, the whole may be cured in a pressure mold to harden the fiber reinforced layer about the end of the handle. The shaft may be of wood, of synthetic material or even a lightweight metal material such as aluminum.

Finally, the blade construct or hockey stick of the present invention may be worked to remove any excess glue material including fiber material that extends beyond the edges the blade. This can be done in a conventional manner such as by cutting, sanding or grinding. This method is well known in the art.

DESCRIPTION OF DRAWINGS

Example embodiments of the invention are illustrated by way of example only in the accompanying drawings wherein:

FIG. 1 is a schematic side elevation view showing a hockey stick incorporating an example embodiment of a blade construct in accordance with the present invention;

FIG. 2 is a cross-sectional view of the blade construct shown in FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 shows a cross-sectional view the same as that of FIG. 2 but illustrating an alternate structure for the blade construct having a wrap around bottom instead of a wear protection bottom piece;

FIG. 4 shows a detailed partial perspective view of the blade construct of the hockey stick of FIG. 1, wherein a portion of a face member is removed to expose a number of the bridge members and pockets of the core cavity member;

FIG. 5 illustrates a number of fiber support strips or fillers; FIG. 6 illustrates a channelled fabric of reinforcing fiber for incorporation into the bridge members as well as the face members of the example embodiment of a blade construct shown in FIG. 1;

FIG. 7 illustrates an intermediate assembly (i.e. rib preform) comprising the fabric and support strips as shown in FIGS. 5 and 6;

FIG. 8 shows a partial detailed view of an intermediate structure of a blade construct prior to curing;

FIGS. 9, 10 and 11 illustrate alternative example intermediate structures prior to curing for the formation of a blade construct in accordable with the present invention; and

FIG. 12 illustrates an example embodiment of a replaceable blade section which incorporates a blade construct of the present invention.

Referring to FIG. 1, a hockey stick blade is shown which incorporates a blade construct of the present invention. The stick comprises a handle section 1 and a blade section indicated generally by the reference numeral 2; for illustration purposes, only a portion of the handle 1 is shown. The blade section 2 comprises a blade construct of the present invention (as shall be explained hereinafter). The lower portion 3 of the handle 1 is attached to the blade section 2 by a fiber reinforced plastics material layer 4 shown as crossed hatching. Although it is not so shown the layer 4 extends right up to the tip 4a of the blade; a similar layer is disposed of the opposite face of the blade. These outer fiber reinforced plastic layers 4 form part of opposed face members of the blade construct as shall be seen below.

The blade as shown in FIG. 1 also includes a wear resistant member 5 for contacting the ice surface (see U.S. Pat. No. 3,982,760 for a further discussion of such members, the entire contents of this patent is incorporate herein by reference), this member may take the aspect of a thermoplastic wear protection bottom piece.

In FIG. 1, the rib bridge members are shown in longitudinally extending outline by the dotted lines 6 (in FIG. 1, only one of the longitudinally extending dotted lines is so designated).

Turning to FIG. 2, this figure shows a cross-section of the blade construct of the ice hockey stick illustrated in FIG. 1. For illustration purposes, the fiber elements, which are part of the structure of the blade, are not shown. As can be seen, the blade has a first face member 7 and a second opposed face member 8. The core cavity member comprises the rib bridge members designated by the reference numerals 9, 10, 11, 12, 13 and 14 and includes elongated pockets 15, 16, 17, 18, 19 and 20 (see also FIG. 4); as may be seen, the elongated pockets are delineated by respective portions of the opposed face members and by the rib bridge members.

FIG. 3 illustrates a blade structure which is essentially the same as that of the blade structure shown for FIGS. 1 and 2, except that this alternate blade structure does not include a lower wear resistant member 5; in its place, there is a further pocket 21 (since the structure of the embodiment illustrated by FIG. 3 is essentially the same as that embodiment shown in FIGS. 1 and 2, the same reference numerals have been used with respect thereto to designate the various elements thereof).

Referring to FIGS. 2 and 4, FIG. 4 shows a partial perspective view of a portion of the blade body indicated generally by the arrow designated 22 in FIG. 2.

As can be seen from FIGS. 2 and 4, the various rib bridge members and the face members are configured such that they delineate the pockets 15 to 20. The rib bridge members extend longitudinally of the blade in the manner illustrated generally by the dotted lines 6 in FIG. 1. Each pocket is spaced or separated from an adjacent pocket by a corresponding rib bridge member; for example, the pockets 16 and 17 are separated from each other by the bridge member 10. The pockets as seen also extend longitudinally of the blade. The pockets are closed off at the tip 4a by fiber reinforced material and at the heel region by the lower portion 3 of the handle 1.

As mentioned above, the face members 7 and 8 as well as the bridge members 9 to 14 and the tip 4a are of a fiber reinforcement plastic material. In FIGS. 2, 3 and 4, only the basic structure is shown without any attempt to show the disposition of fiber elements or components embedded in the resin matrix structure.

FIGS. 2 and 3, for illustration purposes only, show the pockets as being hollow or empty. Although this is a possible version of the core cavity member, the pockets for the embodiment (s) shown in FIGS. 1 to 4 may be filed with a light (polyurethane) foam material (not shown) not intended to provide structural support for the blade construct but for maintaining a fiber component in the bridge member in a transverse (e.g. tensioned) configuration during curing (as shall be explained hereinafter).

A blade construct having longitudinally extending rib bridge members and elongated pockets having light foam material disposed therein may be built up using example intermediate structures such as illustrated in FIGS. 5, 6, 7 and 8.

Referring to FIGS. 5, the intermediate structures for building up the required bridges members include a number of elongated filler strips or inserts 22 (only three are shown and not in their entire length). As mentioned above the strips 22 may be of flexible foam or thermoplastic rigid foam which softens during moulding such that in either case the final intermediate structure may be shaped and cured in a pressure mould to provide the blade construct of desired shape and thickness. The foam strips 22 are disposed such that they are spaced apart so as to leave spaces 23 between adjacent foam strips 22. The strips 22 are maintained in this position by being engaged in respective elongated channels defined by a two layered fabric material which is woven into a channelled fabric having a plurality of elongated channels.

Referring to FIG. 6, a portion of such a channelled fabric is shown. As can be seen, each of the channels of the fabric is formed by opposed cross-over weave members designated 24 and 25 and upper and lower weave members 26 and 27 which connect up with the cross-over weave members 24 and 25. The channelled fabric comprises a plurality of interwoven fiber (e.g. glass) strands and is impregnated with a suitable resin (e.g. an epoxy resin). Some of the strands of fabric run parallel to the lengthwise dimension of the channels, while a second set of strands run perpendicular to the lengthwise dimension i.e. the perpendicularly running strands of the cross over members are to be disposed transverse to the face members in the blade construct.

FIG. 7 illustrates a portion of an example embodiment of a rib preform comprising the fabric and strips of FIGS. 5 and 6. As can be seen, the spaces 23 between the strips 22 are occupied by cross-over fiber members (e.g. cross-over members 24 and 25). As may also be appreciated, the cross-sectional thickness of the strips 22 is such that they fill the elongated channels of the channelled fabric sufficiently to maintain the perpendicular strands of the cross-over members 24 and 25 in a (e.g. tensioned) transverse state during curing of the resin. Sufficient resin is pre-applied to the channelled fabric such that after curing, the spaces between the strips 22 are occupied by a fiber reinforcing plastic material defining the rib bridging members which connect the face members 7 and 8 together. The number of

channel/strip pairs for building the blade construct of FIG. 1 is six. The longitudinal length of the channel/strip pairs is sufficient to provide a blade body having the desired length; the channel/strip pairs for the example blade construct are disposed so as to provide bridge members of a more or less longitudinally straight aspect; the channel/strip members may of course be configured to provide a desired longitudinal extending curved aspect i.e. the bridge members still effectively extending longitudinally as described above. The channel fabric of each of the end or outermost channel/strip members of the preform may be tied off or connected at the junction of the crossover members (i.e. terminated) in any suitable manner since there is no adjacent strip around which the fabric to be wrapped.

A rib preform as illustrated in FIG. 7 is, thereafter, as shown in FIG. 8 (only five of the six channel/strip pairs for the blade construct of FIG. 1 are shown), overlain with reinforcing fabric layers 28 and 29 i.e. the channelled fabric and foam strip combination is sandwiched between the reinforcing fabric 28 and 29. The reinforcing fabric 28 and 29 is also impregnated with a suitable resin. In the embodiment shown, the face members 7 and 8 of the cured construct will comprise the respective reinforced plastic layers 28 and 29 as well as the portions 26 and 27 of the channel/strip members of the rib preform.

The fabric 28 and 29 are sized to extend beyond the outer edges of the rib preform. In this manner the top member and tip member of the blade may be formed by molding and curing the excess fabric to wrap around these areas of the blade core; the excess material being removed (e.g. by grinding, etc.) after curing.

A wear resistant (e.g. thermoplastic) member 5 is disposed adjacent to an end channel/strip member, the excess reinforced plastic layers 28 and 29 in this region being disposed to overlap the resistant members 5 (see FIG. 8) so that the member 5 will be fixed to and form part of the bottom member of the blade structure (see for example U.S. Pat. No. 3,982,760 with respect to the incorporation of a lower resistant member into a hockey blade).

With respect to the hockey stick embodiment as shown in FIG. 1, the heel end of the final intermediate structure may be configured as shown in FIG. 1 so as to matingly contact with the lower end 3 of the handle section 1. Thus the excess reinforcing plastic layers 28 and 29 in this region of the intermediate structure will be extended to overlap the handle portion 3 so that the entire stick may be placed into a suitably formed mold and the handle immediately formed integral with the blade construct during curing of the blade construct. In FIG. 1, the overlapping portion or region of the fiber reinforced layers 28 is designated or referred to by the reference numeral 4*b*. The handle member may be of wood, of a composite material, etc.

The combined elements as shown in FIG. 8 is thereafter cured (along with the handle element) using a mould which will subject the combination to a suitable temperature and pressure for curing the resin and shaping the blade construct into the shape and thickness of a desired blade for a hockey stick.

After curing, the perpendicular rib bridge members will consist of a cured resin having embedded therein the criss-cross weave members (e.g. members 24 and 25) with the strands thereof extending transversally with respect to the face members 7 and 8 (see for example the element designated by the reference number 24*a* in FIG. 8). Once the precursor combination is cured, the elongated pockets of the core cavity member will each be filled with a respective foam strip material. For this embodiment, the rib bridge members are more or less parallel to the longitudinal axis of the blade construct; the rib bridge members could of course extend longitudinally with respect to the blade construct at some angle to the longitudinally axis 36 (see FIG. 1).

Referring to FIG. 12 (on the same sheet of drawings as FIG. 1), instead of a complete handle section 1 being integrally fixed to the blade construct, a handle heel portion 30 having a spigot member 31 may be so fixed to the blade construct. In this way, a replaceable blade section may be obtained which can thereafter matingly and replaceably be fixed to a handle having a corresponding slot at one end thereof.

Referring to FIG. 3, the wear member 5 may be omitted. In this case the bottom running or sliding edge of the blade may be formed by the excess fiber reinforced fabric layers 28 and 29 in this region of the intermediate structure. Thus, during moulding, the fiber reinforced layers of this excess region are (as in the case of the top and tip regions) pinched towards each other and cured any excess material being thereafter removed to obtain the desired shape of the bottom member of the blade.

Referring to FIG. 9, this figure shows another possible rib preform for making the blade construct wherein rib bridge members 5 have embedded therein fiber elements which extend transversally with respect to the face members of the construct. In the preform embodiment shown, the flexible strips 32 are covered with a sock type reinforcing fabric 33. The webs of the sock fabric 33 can run at a controlled angle (e.g. 45°) with respect to the longitudinal axis of the strips (i.e. the weave is of a criss-cross configuration). The fibers of the sock of each of these individual sausage like channel/strip elements may be impregnated with a suitable resin. In order to make the blade construct a number of these appropriately sized and configured "sausages" may be lain side by side sandwiched between appropriate reinforced plastic layers 34 and 35. The sausages are laid side by side so as to obtain a blade construct wherein the bridge members extend longitudinally of the blade construct therebetween.

A FIG. 10 shows a further possible way of building up rib bridge members having the required transverse fiber elements embedded therein. In this rib preform embodiment, a number of strips of rigid foam are disposed side by side such that a single preimpregnated layer of reinforcing fiber fabric or material 38 is layered or intertwined in a continuous fashion around these core strips such that the layer runs from a first side of one strip down between adjacent strips to the opposite surface of the adjacent strip, etc. The blade construct of this version also includes fiber reinforcing fabric layers 39 and 40 such that the blade construct may be cured as mentioned above.

Returning to FIG. 11, this Figure shows a further possible structure for the intermediate fabric thermoplastic strip combination. In this case, the upper and lower (resin impregnated) fabric layers 41 and 42 respectively are spaced apart by a suitable (rigid) foam material 43 (partially shown) such as for example a polyurethane foam slab. The upper and lower fabric layers 41 and 42 are then knitted together by strands 44 of fiber material. The foam slab will hold apart the reinforcing fiber layers 41 and 42 during curing and

moulding so as to obtain the required bridge members spacing the facing members apart and which have transversally extending fabric strands embedded in the bridge members. In this case, the bridge members will take on a post-like configuration since during curring resin will flow by capillary action over the transverse strands or threads 44 such that on curring the threads will be encased in a resin matrix, i.e. the core cavity member will have a plurality of spaced bridge members of post-like configuration.

In accordance with an alternative form for the structure shown in FIG. 11 the foam material 43 may be replaced by a core member which is built up starting from a plurality of layers (e.g. three or more) of reinforcing fiber material. However, at least one of the reinforcing fiber layers of the core cavity member of this structure comprises thermoplastic hollow (micro)spheres which are embedded in the interstices between the fiber. These hollow (micro)spheres serve as a type of filler in order to reduce the specific gravity of the final construct; the (micro)spheres may be present in any desired number and size keeping in mind the role of the spheres is to provide the central core with pockets of empty spaces so as to reduce the (specific) weight of the construct while providing a construct with an acceptable level of strength, resistance, etc. The hollow spheres, may, for example, have a size ranging from 0.01 mm to 0.05 mm.

Suitable types of laminateable core material comprising microspheres are available from Spezialprodukte fur Leichtlaminaten GmbH, Germany. These products are sold under the names "Spherecore" and/or "Spheremat"; these products comprise glass fiber and thermoplastic hollow microspheres disposed in the interstices of the fibers.

In accordance with this alternate structure, suitable numbers of central layers are laid on top of each other keeping in mind the desired thickness of the blade. The layers may all comprise fiber material with the thermoplastic spheres or some of the layers as desired may comprise conventional fiber layers without such spheres; the proportion of the various types of layers will depend on the specific gravity it is desired to have in the end product. As in the case of the embodiment illustrated in FIG. 11, outside layers 41 and 42 would be provided which would be stitched together through the central core fiber layers using a suitable thread like material (e.g. glass fiber or some other high modulus fiber) in order to form the transverse fiber reinforcing component connecting the first surface layer to the second surface layer.

Thereafter, the over all combination may be impregnated with a low viscosity epoxy or polyester resin and then cured and pressed in a mould to the desired shape of the hockey stick blade. The cured plurality of central layers of fiber mat or woven fabric would provide the basic core cavity member with a cellular structure, i.e. a structure comprising a plurality of hollows or cavities.

With this latter type of structure, the specific gravity of the blade may, for example, be reduced to a level of about 0.85. The amount of the layer material comprising the microspheres may be determined in light of the desired degree of weight, stiffness and strength desired in the final structure.

What is claimed is:

1. A blade construct for a hockey stick, said blade construct comprising a blade body having
 a first face member, and
 a second opposed face member,
 said first and second face members being spaced apart and being of fiber reinforced plastics material,
 characterized in that,
 a core cavity member is sandwiched between said first and second face members,
 said core cavity member comprises one or more bridge members of fiber reinforced plastics material,
 said first face member, said second face member and said bridge members are integral, and
 one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

2. A blade construct as defined in claim 1 characterized in that said cavity member comprises a plurality of said bridge members and a plurality of the bridge members comprise a fiber reinforcing component oriented transversely with respect to said first and second face members.

3. A blade construct as defined in claim 1 characterized in that said cavity member comprises a plurality of said bridge members, each of the bridge members of said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

4. A blade construct as defined in claim 1 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

5. A blade construct as defined in claim 1 characterized in that one or more of said bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

6. A blade construct as defined in claim 3 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

7. A blade construct as defined in claim 5 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

8. A blade construct for a hockey stick, said blade construct comprising a blade body having
 a first face member, and
 a second opposed face member,
 said first and second face members being spaced apart and being of fiber reinforced plastics material,
 characterized in that,
 a core cavity member is sandwiched between said first and second face members,
 said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,
 said rib bridge members extend longitudinally of said blade body,
 said first face member, said second face member and said rib bridge members are integral, and
 one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

9. A blade construct as defined in claim 8 characterized in that said cavity member comprises a plurality of said rib bridge members, each of the bridge members of

said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

10. A blade construct as defined in claim 8 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

11. A blade construct as defined in claim 8 characterized in that one or more of said rib bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

12. A blade construct as defined in claim 9 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

13. A blade construct as defined in claim 11 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

14. A blade construct as defined in claim 9 characterized in that each said rib bridge member comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members and each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

15. A hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises one or more bridge members of fiber reinforced plastics material,

said first face member, said second face member and said bridge members are integral, and

one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

16. A hockey stick as defined in claim 15 characterized in that said cavity member comprises a plurality of said bridge members and a plurality of the bridge members comprise a fiber reinforcing component oriented transversely with respect to said first and second face members.

17. A hockey stick as defined in claim 15 characterized in that said cavity member comprises a plurality of said bridge members, each of the bridge members of said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

18. A hockey stick as defined in claim 15 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

19. A hockey stick as defined in claim 15 characterized in that one or more of said bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

20. A hockey stick as defined in claim 17 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

21. A hockey stick as defined in claim 19 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

22. A hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,

said rib bridge members extend longitudinally of said blade,,

said first face member, said second face member and said rib bridge members are integral, and

one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

23. A hockey stick as defined in claim 22 characterized in that said cavity member comprises a plurality of said rib bridge members, each of the rib bridge members of said plurality of rib bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

24. A hockey stick as defined in claim 22 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

25. A hockey stick as defined in claim 22 characterized in that one or more of said rib bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

26. A hockey stick as defined in claim 23 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

27. A hockey stick as defined in claim 25 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

28. A hockey stick as defined in claim 23 characterized in that each said rib bridge member comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members and each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

29. A blade construct for a hockey stick, said blade construct comprising a blade body having

a first face member, and

a second opposed face member, said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows so as to provide the core cavity member with a cellular structure,

said first face member, said second face member and said bridge body are integral, and

said bridge body comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

30. A blade construct as defined in claim 29 characterized in that said hollows are microhollows.

31. A blade construct as defined in claim 29, characterized in that the bridge body comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

* * * * *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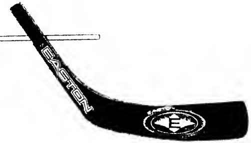
2001
ARE YOU READY?

PRODUCT>> BLADES **SKU NUMBER>> SEE BELOW**



FEATURES>> FOCUS

> Pro-Spec carbon
> Ultra thin blade profile
> 155 Grams
> Yzerman – **A119301**, Shanahan – **A119304**, Sakic – **A119303**, Modano – **A119308**, Lidstrom – **A119302**

> Carbone de précision professionnel
> Modèle de tenon flexible focalisé
> 155 grammes
> Yzerman – **A119301**, Shanahan – **A119304**, Sakic – **A119303**, Modano – **A119308**, Lidstrom – **A119302**

PRODUCT>> BLADES **SKU NUMBER>> SEE BELOW**

FEATURES>>

> Kevlar®/graphite interlock
> Z-Tac
> 180 Grams
> Yzerman – **A119204**, Shanahan – **A119108**, Sakic – **A119311**, Modano – **A119309**, Lidstrom – **A119206**, Jr Yzerman – **A119158**, Jr Shanahan – **A119307**

> Interlock au Kevlar®/graphite
> Z-Tac
> 180 grammes
> Yzerman – **A119204**, Shanahan – **A119108**, Sakic – **A119311**, Modano – **A119309**, Lidstrom – **A119206**, Jr Yzerman – **A119158**, Jr Shanahan – **A119307**

PRODUCT>> BLADES **SKU NUMBER>> SEE BELOW**

FEATURES>>

> Graphite interlock
> 200 Grams
> Yzerman – **A119202**, Shanahan – **A119111**, Sakic – **A119312**, Modano – **A119310**, Lidstrom – **A119201**

> Interlock au graphite
> 200 grammes
> Yzerman – **A119202**, Shanahan – **A119111**, Sakic – **A119312**, Modano – **A119310**, Lidstrom – **A119201**

PRODUCT>> BLADES **SKU NUMBER>> SEE BELOW**

FEATURES>> CARBON

> Easton hybrid technology
> Carbon paddle
> EPX multi-lami hosel
> 185 Grams
> Yzerman – **A119315**, Shanahan – **A119318**, Modano – **A119317**, Drury – **A119316**

> Technologie hybride d'Easton
> Palette en carbone
> Embout multi-laminé en EPX
> 185 grammes
> Yzerman – **A119315**, Shanahan – **A119318**, Modano – **A119317**, Drury – **A119316**

PRODUCT>> BLADES **SKU NUMBER>> SEE BELOW**

FEATURES>>

> Handcrafted
> Wood 525-10 system
> EPX-T hybrid hosel
> Yzerman – **A119152**, Sakic – **A119151**, Modano – **A119159**, Lidstrom – **A119153**

> Fait à la main
> Bois 525-10
> Embout hybride en EPX-T
> Yzerman – **A119152**, Sakic – **A119151**, Modano – **A119159**, Lidstrom – **A119153**

Boot Sizing

Skates

	Junior												Senior														
Easton Skate Size	12	13	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5
North American*	13.5	1.5	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14
European*	34	34.5	35	35.5	36	36.5	37	37.5	38	38.5	39	40	40.5	41	42	42.5	43	44	44.5	45	46	46.5	47	47.5	48	48.5
United Kingdom*	13	1	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5

*Equivalent Shoe Size

Shoulder Pads

Product/ Produit	Model/ Modele	Height 3'4"-4'	4'-4'10"	4'10"-5'6"	5'4"-6'	5'8"-6'4"	6'+
	Chest Size	24"-28"	28"-32"	32"-36"	36"-40"	40"-44"	44"+
Shoulder Pad	Z-Air			S	S-M	M-L	XL
Shoulder Pad	Air		Jr.S-Jr.M	Jr.L-S	S-M	M-L	XL
Shoulder Pad	Ultra Lite		Jr.S-Jr.M	Jr.L-S	S-M	M-L	XL
Shoulder Pad	X-Treme		Jr.S-Jr.M	Jr.L-S	S-M	M-L	XL
Shoulder Pad	Classic Air			S	S-M	M-L	XL
Shoulder Pad	Yzerman Y19	S-M-L	L				

Shin Guards

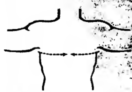
Product/ Produit	Model/ Modele	Height 3'4"-3'8"	3'8"-4'	4'-4'4"	4'4"-4'8"	4'8"-5'	5'-5'4"	5'4"-5'8"	5'8"-6'	6'-6'4"	6'4"+
Shin Guard	Z-Air							14"	15"	16"	
Shin Guard	Air					12"	13"	14"	15"	16"	
Shin Guard	Ultra Lite			10"	11"	12"	13"	14"	15"	16"	17"
Shin Guard	X-Treme			10"	11"	12"	13"	14"	15"	16"	17"
Shin Guard	Classic Air							14"	15"	16"	
Shin Guard	Yzerman Y19	8"	9"	10"	11"	12"					

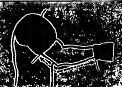
Elbow Pads

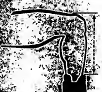
Product/ Produit	Model/ Modèle	Height 3'4"-4'	4'-4'10"	4'10"-5'6"	5'4"-6'	5'8"-6'4"	6'+
Elbow Pad	Z-Air			S	S-L	S-L	L
Elbow Pad	Air		Jr S	Jr L-S	S-L	S-L	L
Elbow Pad	Ultra Lite		Jr. S	Jr. L-S	S-L	S-L	L
Elbow Pad	X-Treme		Jr S	Jr. L-S	S-L	S-L	L
Elbow Pad	Classic Air			S	S-L	S-L	L
Elbow Pad	Yzerman Y19	S-L					

Blades

	Series	Mid 9/16 15 mm Lie 6	Heel 1/2 12 mm Lie 5.5	Heel 3/8 9 mm Lie 6	Toe 3/4 18 mm Lie 6	Mid 3/4 19mm Lie 5.5	Mid 1/2 12mm Lie 5.5	Mid-Heel 3/8 9mm Lie 5	Heel 1/2 14 mm Lie 5.5
Composite	Z-Carbon	Yzerman	Lidstrom		Shanahan		Sakic	Modano	
Composite	Ultra Lite Kevlar	Yzerman	Lidstrom		Shanahan		Sakic	Modano	
Composite	Jr.Ultra Lite Kevlar	Shanahan Jr.			Yzerman Jr.				
Composite	Ultra Graphite	Yzerman	Lidstrom		Shanahan		Sakic	Modano	
Wood	Hybrid RB	Yzerman			Shanahan			Modano	Drury
Wood	T-Flex	Yzerman	Lidstrom				Sakic	Modano	
Wood	RB Fiber Plus			Thornton	Shanahan		Sakic	Modano	
Wood	RB Lam	Yzerman	Lidstrom		Shanahan			Modano	
Wood	RB Pro	Yzerman	Lidstrom	Thornton	Shanahan	Roenick	Sakic	Modano	
Wood	RB Pro Jr.	Yzerman			Shanahan		Sakic	Modano	
ABS	Z-ABS	Yzerman							
ABS	Jr Z-ABS	Yzerman							
ABS	X-ABS				Shanahan				
ABS	Jr X-ABS				Shanahan				







Shoulder Pads

1. Measure the player's chest just below the arm pits.
2. Match the player's chest measurement to the shoulder pad size in inches.

Note: Shoulder pads should fit snugly with the tips of the shoulders properly positioned under the shoulder caps.

Elbow Pads

1. Measure the length between the shoulder pad and the cuff of the glove.
2. Match the player's measurement size to the size of the elbow pad in inches.

Note: When fastened securely, there should be [illegible] between the pad and either the bicep [illegible] of the shoulder pad or cuff of the glove. Players who wear a short cuff styled glove should choose the longer model of the elbow pad.

Shin Guards

Shin guards are best fitted while the player is sitting. To fit properly:

1. Measure from the center of the knee cap to the top of the skate boot.
2. Match the player's shin measurement to the size of the shin guard.

Note: Shin guards should be secured with proper shin guard strap.

Pants

Product/ Produit	Model/ Modele	XXS / TTP	XS / TP	S / P	M / M	L / G	XL / TG
Pants	Z-Air		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Air		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Air Junior		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	Air Women	44 (26"-28")	46 (29"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Ultra Lite		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Ultra Lite Jr.		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	X-Treme		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	X-Treme Jr		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	Yzerman Y19			(20"-22")	(22"-24")	(24"-26")	


EASTON
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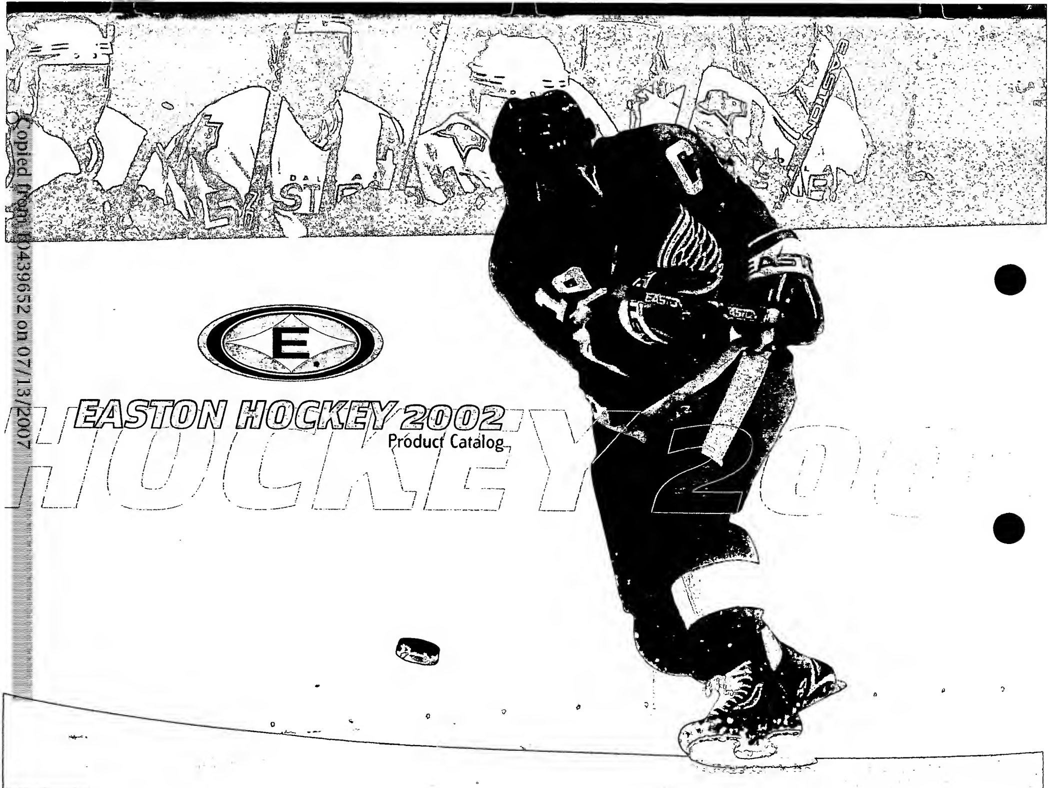
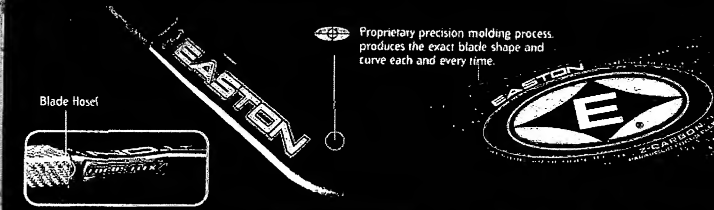

EASTON HOCKEY 2002
Product Catalog
HOCKEY 2002

Featured
Z-CARBON
THE MOST DOMINANT BLADE IN THE NHL
17.8% of NHL players use Easton blades



Patent pending Focus Flex technology and construction

Theo Fleury 14 New York Rangers

Z-CARBON/JR. Z-CARBON

A119301 [illegible] / A119303 Sakic / A119306 Modano / A119302 [illegible] / A119304 [illegible]
A119325 [illegible] Jr. / A119326 Modano Jr.

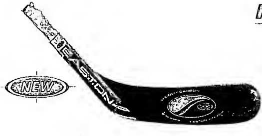
NEW

T-FLEX GRAPHITE

A119322 [illegible]

NEW

EASTON



HYBRID PRO/JR. HYBRID PRO

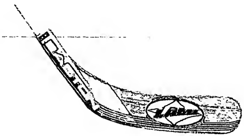
CARBON FUSION TECHNOLOGY | HYBRID | PRECISION MOLDED

Sku: **A119320** Yzerman /**A119319** Modano / **A119321** Shanahan / **A119322** Drury / **A119323** Yzerman Jr. / **A119324** Modano Jr.

Features:
- Patent-pending Carbon Fusion Technology
- Compresson molded carbon paddle
- High grade hickory hosel
- 190 grams/165 grams Jr.

Features:
- Technologie de fusion de carbone en instance de brevet
- Palette en carbone moulée par compression
- Manchon en noyer blanc d'Amérique de grande qualité
- 190 grammes/165 grammes Junior

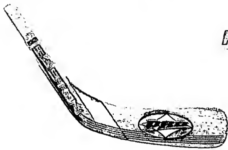
LAMI



Sku: **A119156** Yzerman / **A119163 Modano** / **A119155** Lidstrom / **A119121** Shanahan

Features:
- Handcrafted
- Wood 525-10 system
- EPX multi-lami hosel

Features:
- Fait à la main
- Système en bois 525-10
- Manchon multistratifié EPX



PRO/JR. PRO

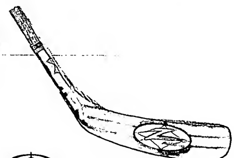
Sku: **A119146** Roenick / **A119149** Yzerman / **A119165** Sakic / **A119162** Modano / **A119145** Lidstrom / **A119123** Shanahan
A119150 Yzerman Jr. / **A119102** Shanahan Jr. / **A119144** Sakic Jr. / **A119168** Modano Jr.

Features:
- Handcrafted
- High grade hickory hosel

Features:
- Fait à la main
- Manchon en noyer blanc d'Amérique de grande qualité

PRECISION MOLDED

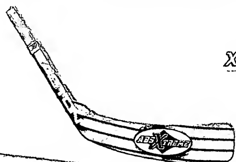
Z-ABS/JR. Z-ABS



Sku: **A119136** Yzerman / **A119135** Yzerman Jr.

Features:
- Wood/ABS hybrid
- High grade hickory hosel

Features:
- Bâton hybride en bois/ABS
- Manchon en noyer blanc d'Amérique de grande qualité



X-ABS/JR. X-ABS

PRECISION MOLDED

Sku: **A119130** Shanahan / **A119105** Shanahan Jr.

Features:
- ABS/fiber paddle
- High grade hickory hosel

Features:
- Palette en ABS/fibre
- Manchon en noyer blanc d'Amérique de grande qualité

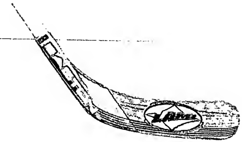
HYBRID PRO/JR. HYBRID PRO

Sku: **A119320** Yzerman / **A119319** Modano / **A119321** Shanahan / **A119322** Drury / **A119323** Yzerman Jr. / **A119324** Modano Jr.

Features
- Patent-pending Carbon Fusion Technology
- Compresson molded carbon paddle
- High grade hickory hosel
- 190 grams/165 grams Jr.

Features
- Technologie de fusion de carbone en instance de brevet
- Palette en carbone moulée par compression
- Manchon en noyer blanc d'Amérique de grande qualité
- 190 grammes/165 grammes Junior

LAMI

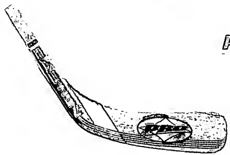


Sku: **A119156** Yzerman / **A119163** Modano / **A119155** Lidstrom / **A119121** Shanahan

Features
- Handcrafted
- Wood 525-10 system
- EPX multi-lami hosel

Features
- Fait à la main
- Système en bois 525-10
- Manchon multistratifié EPX

PRO/JR. PRO

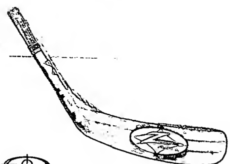


Sku: **A119146** Roenick / **A119149** Yzerman / **A119165** Sakic / **A119162** Modano / **A119145** Lidstrom / **A119123** Shanahan
A119150 Yzerman Jr. / **A119102** Shanahan Jr. / **A119144** Sakic Jr. / **A119168** Modano Jr.

Features
- Handcrafted
- High grade hickory hosel

Features
- Fait à la main
- Manchon en noyer blanc d'Amérique de grande qualité

Z-ABS/JR. Z-ABS

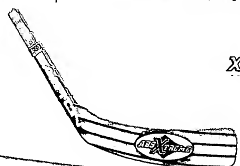


Sku: **A119136** Yzerman / **A119135** Yzerman Jr.

Features
- Wood/ABS hybrid
- High grade hickory hosel

Features
- Bâton hybride en bois/ABS
- Manchon en noyer blanc d'Amérique de grande qualité

X-ABS/JR. X-ABS



Sku **A119130** Shanahan / **A119105** Shanahan Jr.

Features
- ABS/fiber paddle
- High grade hickory hosel

Features
- Palette en ABS/fibre
- Manchon en noyer blanc d'Amérique de grande qualité

BLADES

	Series	Mid 9/16 15 mm Lie 6	Heel 1/7 12 mm Lie 5.5	Toe 3/4 18 mm Lie 6	Mid 3/4 19mm Lie 5.5	Mid 1/2 12mm Lie 5.5	Mid Heel 3/8 9mm Lie 5	Heel 1/2 14 mm Lie 5.5
COMPOSITE	T Flex Graphite							Drury
	Z Carbon	Yzerman	Lidstrom	Shanahan		Sakic	Modano	
	Jr Z Carbon	Yzerman Jr					Modano Jr.	
	Ultra Lite	Yzerman	Lidstrom	Shanahan		Sakic	Modano	
	Jr. Ultra Lite	Shanahan Jr		Yzerman Jr.				
	Ultra Graphite	Yzerman	Lidstrom	Shanahan		Sakic	Modano	
WOOD	Hybrid Lami RB	Yzerman		Shanahan			Modano	Drury
	T Flex	Yzerman	Lidstrom			Sakic	Modano	
	RB Fiber +			Shanahan		Sakic	Modano	
	Hybrid Pro RB	Yzerman		Shanahan			Modano	Drury
	RB Lami	Yzerman	Lidstrom	Shanahan			Modano	
	RB Pro	Yzerman	Lidstrom	Shanahan	Roenick	Sakic	Modano	
	Jr. Hybrid Pro RB	Yzerman Jr					Modano Jr.	
	Jr RB Pro	Yzerman Jr		Shanahan Jr		Sakic Jr	Modano Jr	
ABS	Z ABS	Yzerman						
	Jr. Z ABS	Yzerman Jr						
	X-ABS			Shanahan				
	Jr. X ABS			Shanahan Jr				

SHOULDER PADS

1) Measure the player's chest just below the arm pits

2) Match the player's chest measurement to the shoulder pad size in inches

NOTE: Shoulder pads should fit snugly with the tips of the shoulders properly positioned under the shoulder caps

ELBOW PADS

1) Measure the length between the shoulder pad and the cuff of the glove

2) Match the player's measurements size to the size of the elbow pad in inches

NOTE: When fastened securely there shouldn't be a gap between the elbow pad and either the biceps extension of the shoulder pad or cuff of glove. Players who wear a short, cuff styled glove should choose the longer model of the elbow pad

SHINGUARDS

Shin guards are best fitted while the player is sitting. To fit properly

1) Measure from the center of the knee cap to the top of the skate boot

2) Match the players shin measurement to the size of the shin guard

NOTE: Secure shin guard with the proper strap if it has not been built in to the equipment

COMPOSITES

	Model Modèle	Stiffness Lb/in (GM) Rigidité	Feel	Wear	Weight Poids	Length Longueur	Material Matériau
COMPOSITE STICKS	Synergy 110 Grip Yzerman	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 110 Grip Lidstrom	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 110 Grip Sakic	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 110 Grip Shanahan	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 110 Grip Modano	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 110 Grip Drury	110 XX Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Yzerman	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Lidstrom	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Sakic	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Shanahan	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Modano	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Grip Drury	100 Stiff Flex	10	9	460	56	Graphite/Aramid/Grip
	Synergy 100 Yzerman	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 100 Lidstrom	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 100 Sakic	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 100 Shanahan	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 100 Modano	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 100 Drury	100 Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Yzerman	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Lidstrom	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Sakic	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Shanahan	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Modano	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 85 Drury	85 M Stiff Flex	10	9	460	56	Graphite/Aramid
	Synergy 75 Modano	75 M Stiff Flex	10	9	420	54	Graphite/Aramid
	Synergy 75 Drury	75 M Stiff Flex	10	9	420	54	Graphite/Aramid
	Jr Synergy 50 Modano	50 Stiff Flex	10	9	320	47	Aramid/Carbon/Glass
	Jr Synergy 50 Yzerman	50 Stiff Flex	10	9	320	47	Aramid/Carbon/Glass
SENIOR SHAFTS	Z Bubble 110 Grip	110 XX Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z Bubble 100 Grip	100 Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z Bubble 85 Grip	85 M Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z Bubble 110	110 XX Stiff Flex	9	8	280	50	Graphite/Aramid
	Z-Bubble 100	100 Stiff Flex	9	8	280	50	Graphite/Aramid
	Z Bubble 85	85 M Stiff Flex	9	8	280	50	Graphite/Aramid
	Grip Lite 110	110 XX Stiff Flex	8.5	8.5	300	50	Graphite/Aramid/Grip
	Grip Lite 100	100 Stiff Flex	8.5	8.5	300	50	Graphite/Aramid/Grip
	Ultra Lite 110	110 XX Stiff Flex	8.5	8	295	50	Graphite/Aramid
	Ultra Lite 100	100 Stiff Flex	8.5	8	295	50	Graphite/Aramid
	T Flex Graphite	100 Stiff Flex	9	8.5	275	50	Graphite/Aramid
	Cyclone Graphite 95	95 Stiff Flex	8.5	8	270	50	Graphite/Aramid
	Typhoon 80	80 M Stiff Flex	7	7.5	340	50	Graphite/Glass
	Ultra Carbon	100 Stiff Flex	6.5	7	340	50	Carbon/Glass
	E Flex Yzerman Composite	80 M Stiff Flex	6	6	380	5	Carbon/Glass
INT.	Z Bubble 75 Grip	75 M Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Cyclone Graphite 70	70 M Stiff Flex	8.5	8	270	50	Graphite/Aramid
	Typhoon 70	70M Stiff Flex	7	7.5	320	50	Graphite/Glass
JUNIOR	Jr Z-Bubble 50	50 Stiff Flex	9	8	200	43	Aramid/Glass
	Jr Grip Lite 60	60 Stiff Flex	8.5	8.5	200	43	Aramid/Glass/Grip
	Jr Ultra Lite 65	Stiff Flex	8.5	8	200	43	Aramid/Glass
	Jr Typhoon 45	45 M Stiff Flex	7	7.5	215	43	Carbon/Glass
	Jr Ultra Carbon	60 Stiff Flex	6.5	7	260	43	Carbon/Glass
	Jr E-Flex Yzerman Composite	M Stiff Flex	6	6	295	43	Carbon/Glass
	Y 19 Composite	45 M Stiff Flex	8	8	250	39	Carbon/Glass

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Synthesis

A119341 Yzerman / A119338 Sakic / A119335 Modano / A119337 Lidstrom / A119339 Shanahan
A119336 Drury / A119340 Iginla

Features	Caractéristiques
> Low kick blade design	> Design avec point de frappe bas
> Pro-spec carbon construction	> Fabrication à base de carbone Pro-spec
> Proprietary structural design	> Design structurel unique
> Ultra thin blade geometry	> Géométrie de la lame ultra-mince
> New hot melt attachment formulation	> 145 grammes
> 145 grams	


NEW


NEW

Synthesis Intermediate

A119342 Sakic / A119343 Modano / A119344 Drury

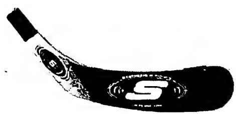
Features	Caractéristiques
> Low kick blade design	> Design avec point de frappe bas
> Pro-spec carbon construction	> Fabrication à base de carbone Pro-spec
> Proprietary structural design	> Design structurel unique
> Ultra thin blade geometry	> Géométrie de la lame ultra-mince
> New hot melt attachment formulation	> 140 grammes
> 140 grams	

Synthesis Jr.

A119346 [illegible] / A119345 Modano Jr.

Features	Caractéristiques
> Low kick blade design	> Design avec point de frappe bas
> Pro-spec carbon construction	> Fabrication à base de carbone Pro-spec
> Proprietary structural design	> Design structurel unique
> Ultra thin blade geometry	> Géométrie de la lame ultra-mince
> New hot melt attachment formulation	> 130 grammes
> 130 grams	

NEW



Z-Carbon/ Z Carbon Jr.

PATENTED

A119301 / A119303 / A119308 / A119302 / A119304 / A119359
A119325 / A119326 Jr.

- Pro-spec carbon construction
- Proprietary structural design
- Proprietary Parabolic Focus Flex™ zone
- Ultra thin blade geometry
- 155 grams / 130 grams Jr.

- Fabrication à base de carbone Pro-spec
- Design structurel unique
- Zone unique avec point d'inflexion localisé parabolique (Focus Flex™)
- Géométrie de la lame ultra-mince
- 155 grammes / 130 grammes Jr.

Ultra Lite/Ultra Lite Jr.

A119204 / A119311 / A119309 / A119206 - A119108
A119158 Jr. / A119307 Jr.

- Mylar reinforced Aramid construction
- 175 grams / 160 grams Jr.

- Fabrication à base d'aramide renforcée de Mylar
- 175 grammes / 160 grammes Jr.

Ultra Graphite

A119202 A119312 / A119310 A119201 A119111

- Graphite interlock braided
- 200 grams

- Double tresse de graphite
- 200 grammes

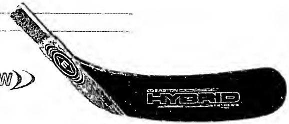
Hybrid Synthesis

Sku: **A119331** Yzerman / **A119334** Sakic / **A119330** Modano / **A119333** Shanahan / **A119332** Drury

Features:
- > 100% graphite blade construction
- > Low-kick blade design
- > New, 360 degree Lock joint
- > New hot melt attachment formulation
- > Mylar reinforced fiber braid
- > EPX-T hybrid hosel
- > 160 grams

Features:
- > Lame fabriquée de graphite à 100%
- > Design avec point de frappe bas
- > Nouveau! Blocage du joint à 360 degrés
- > Tresse de fibres renforcée au Mylar
- > Tuyau hybride EPX_T
- > 160 grammes

NEW



NEW

Hybrid Lami

Sku: **A119350** Yzerman / **A119351** Sakic / **A119348** Modano / **A119349** Shanahan / **A119347** Drury

Features:
- > 100% graphite blade construction
- > New, 360 degree Lock joint
- > Mylar reinforced fiber braid
- > EPX multi-lami hosel
- > 175 grams

Features:
- > Lame fabriquée de graphite à 100%
- > Nouveau! Blocage du joint à 360 degrés
- > Tresse de fibres renforcée au Mylar
- > Tuyau multi laminé EXP
- > 175 grammes

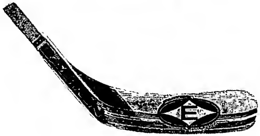
Hybrid Pro/Hybrid Jr.

Sku: **A119355** Yzerman / **A119356** Sakic / **A119353** Modano / **A119354** Shanahan / **A119352** Drury / **A119324** Yzerman Jr. / **A119323** Modano Jr.

Features:
- > 100% graphite blade construction
- > New, 360 degree Lock joint
- > Mylar reinforced fiber braid
- > High grade hickory hosel
- > 195 grams/165 grams Jr.

Features:
- > Lame fabriquée de graphite à 100%
- > Nouveau! Blocage du joint à 360 degrés
- > Tresse de fibres renforcée au Mylar
- > Tuyau de noyer de haute qualité
- > 195 grammes/165 grammes

NEW



Fibre Plus

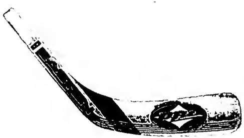
Sku: **A119154** Sakic / **A119164** Modano / **A119117** Shanahan

Features:	Features:
> Handcrafted	> Fait à la main
> 525-K Aramid system	> Système à base d'aramide 525K
> Graphite/glass hosel	> Tuyau à base de graphite et de verre

Lami

Sku: **A119156** Yzerman / **A119163** Modano / **A119155** Lidstrom / **A119121** Shanahan

Features:	Features:
> Handcrafted	> Fait à la main
> Wood 525-10 system	> Système de bois 525-10
> EPX multi-lami hosel	> Tuyau multi laminé EXP



Pro/Pro Jr.

Sku: **A119146** Roenick / **A119149** Yzerman / **A119165** Sakic / **A119162** Modano / **A119145** Lidstrom / **A119123** Shanahan **A119150** Yzerman Jr. / **A119144** Sakic Jr. / **A119168** Modano Jr. / **A119102** Shanahan Jr. (**A119170** P23 / **A119169** P4 **A119172** P23 Jr. / **A119171** P4 Jr. Europe Only)

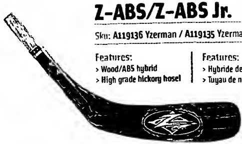
Features:	Features:
> Handcrafted	> Fait à la main
> High grade hickory hosel	> Tuyau de noyer de haute qualité

Z-ABS/Z-ABS Jr.

PRECISION MOLDED

Sku: **A119136** Yzerman / **A119135** Yzerman Jr.

Features:	Features:
> Wood/ABS hybrid	> Hybride de bois et de ABS
> High grade hickory hosel	> Tuyau de noyer de haute qualité

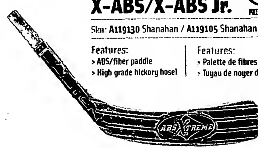


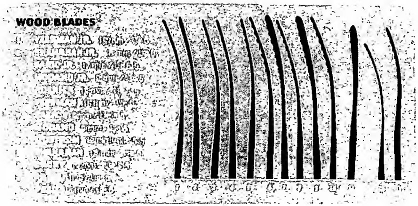
X-ABS/X-ABS Jr.

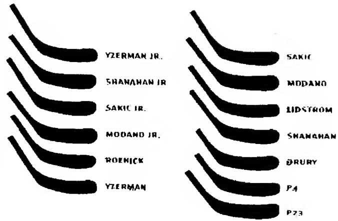
PRECISION MOLDED

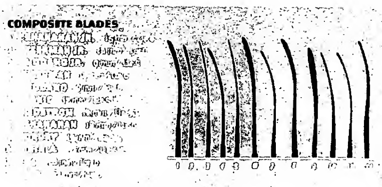
Sku: **A119130** Shanahan / **A119105** Shanahan Jr.

Features:	Features:
> ABS/fiber paddle	> Palette de fibres et de ABS
> High grade hickory hosel	> Tuyau de noyer de haute qualité




WOOD BLADES


YZERMAN JR.
SHANAHAN JR
SAKIC JR.
MODANO JR.
ROENICK
YZERMAN
SAKIC
MODANO
LIDSTROM
SHANAHAN
DRURY
P4
P23


COMPOSITE BLADES


SHANAHAN JR.
YZERMAN JR.
MODANO JR.
YZERMAN
MODANO
SAKIC
LIDSTROM
SHANAHAN
DRURY
IGINLA
P4
P23

Model Modèle	Stiffness (lb/in) Rigidité	Curve	Length Longueur	Material Matériau
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Lidstrom	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Sakic	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Yzerman	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Drury	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Shanahan	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Modano	62	Carbon/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Lidstrom	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Sakic	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Yzerman	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Drury	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Shanahan	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Modano	61	Birch Veneer/Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Lidstrom	60	Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Sakic	50	Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Yzerman	60	Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Drury	60	Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Shanahan	60	Glass Laminate
Z-Carbon 95 Hybrid	95 Stiff Flex	Modano	50	Glass Laminate
Z-Carbon 70 Hybrid	70 M-Stiff Flex	Modano	60	Glass Laminate
Z-Carbon 70 Hybrid	70 M-Stiff Flex	Drury	60	Glass Laminate
Z-Carbon 65 Hybrid	65 Stiff Flex	Modano	53	Carbon/Glass Laminate
Z-Carbon 65 Hybrid	65 Stiff Flex	Yzerman	53	Carbon/Glass Laminate
Z-Carbon 50 Hybrid	50 M-Stiff Flex	Modano	53	Glass Laminate
Z-Carbon 50 Hybrid	50 M-Stiff Flex	Yzerman	53	Glass Laminate
Ultra Lite	105 X Stiff Flex	Modano	50	Box Core Laminate
Ultra Lite	105 X Stiff Flex	Shanahan	60	Box Core Laminate
Ultra Lite	105 X Stiff Flex	Sakic	60	Box Core Laminate
Ultra Lite	105 X Stiff Flex	Lidstrom	60	Box Core Laminate
Fibre Lite	100 Stiff Flex	Modano	50	Glass Molded
Fibre Lite	100 Stiff Flex	Shanahan	56	Glass Molded
Fibre Lite	100 Stiff Flex	Sakic	50	Glass Molded
Fibre Lite	100 Stiff Flex	Lidstrom	60	Glass Molded
Classic	95 Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic	95 Stiff Flex	Sakic	58.5	Aspen Core/Aircraft Veneer
Classic	95 Stiff Flex	Shanahan	58.5	Aspen Core/Aircraft Veneer
Classic	95 Stiff Flex	Modano	58.5	Aspen Core/Aircraft Veneer
Classic Intermediate	70 M-Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic Intermediate	70 M-Stiff Flex	Modano	58.5	Aspen Core/Aircraft Veneer
Classic Jr	50 M-Stiff Flex	Yzerman	52	13-ply Horz
Classic Jr	50 M-Stiff Flex	Shanahan	52	13-ply Horz
Classic Jr	50 M-Stiff Flex	Modano	52	13-ply Horz
Classic Youth	45 M-Stiff Flex	Yzerman	45	13-ply Vert
Z-ABS	Pro Stiff	Yzerman	60	Aspen Core/Glass Molded
Z-ABS Jr	Pro Stiff	Yzerman	52	13-ply Horz
Ultra ABS	Power Flex	Shanahan	58	ABS Wood
Ultra ABS Jr	Power Flex	Shanahan	52	ABS Wood
Ultra ABS Youth	Power Flex	Shanahan	45	13-ply Vert

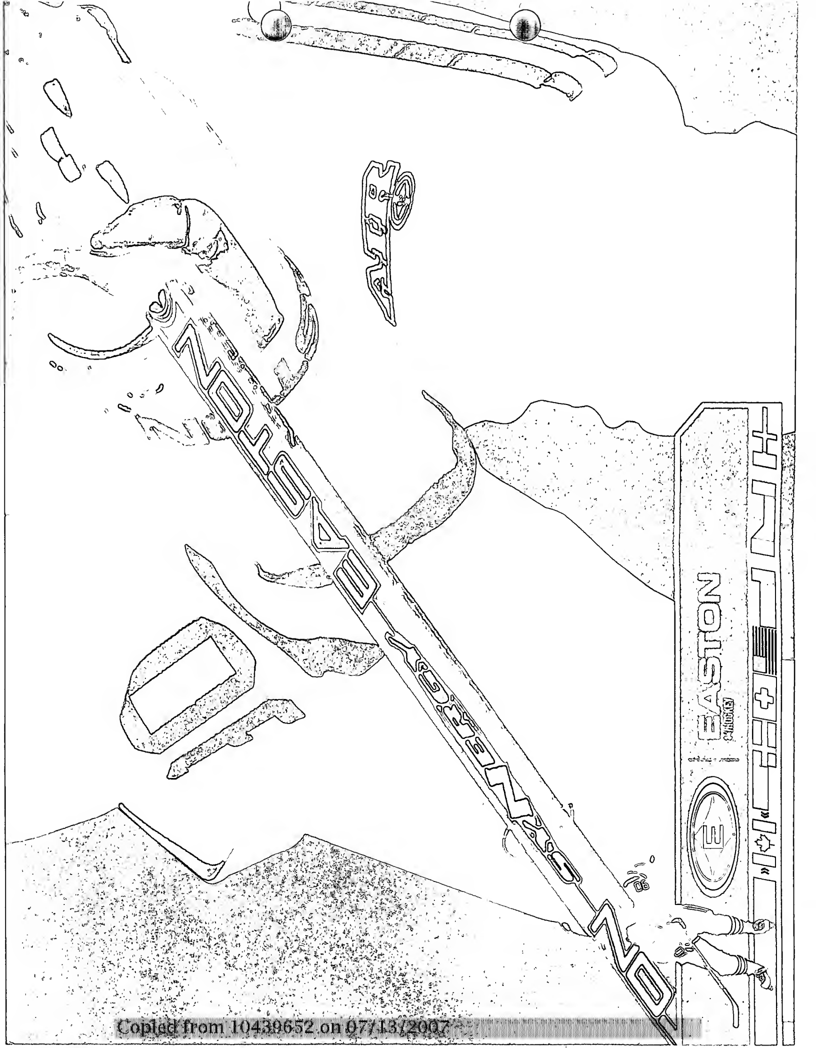
BLADES

	Series	Mid 9-16 15 mm Lie 6	Heel 1/2 12 mm Lie 5.5	Toe 3/4 12 mm Lie 6	Mid 3/4 13mm Lie 5.5	Mid 1/2 12mm Lie 5.5	Mid Heel 3/8 9mm Lie 5	Heel 1-2 12 mm Lie 5.5	Mid 1/2 12mm Lie 5.5	Mid 5-8 14mm Lie 6	Toe 3/4 18mm Lie 6
COMPOSITE	Synthesis Sr.	Yzerman	Lidstrom	Shanahan		Sakic	Modano	Drury	Iginla		
	Synthesis Int					Sakic	Modano	Drury			
	Synthesis Jr					Yzerman Jr	Modano Jr.				
	Z-Carbon	Yzerman	Lidstrom	Shanahan		Sakic	Modano	Drury			
	Jr. Z-Carbon					Yzerman Jr	Modano Jr				
	Ultra Lite	Yzerman	Lidstrom	Shanahan		Sakic	Modano				
	Jr. Ultra Lite	Shanahan Jr				Yzerman Jr					
	Ultra Graphite	Yzerman	Lidstrom	Shanahan		Sakic	Modano				
HYBRID/WOOD	Hybrid Synthesis RB	Yzerman		Shanahan			Modano	Drury			
	Hybrid Lam 0ls	Yzerman		Shanahan			Modano	Drury			
	Hybrid Pro PB	Yzerman		Shanahan			Modano	Drury			
	Jr. Hybrid Pro RB	Yzerman Jr					Modano Jr				
	RB Fiber Plus			Shanahan		Sakic	Modano				
	RB Lite	Yzerman	Lidstrom	Shanahan			Modano				
	RB Pro	Yzerman	Lidstrom	Shanahan	Roenick	Sakic	Modano			P22	P4
	Jr. RB Pro	Yzerman Jr		Shanahan Jr		Sakic Jr	Modano Jr			P23	P4
ABS	Z-ABS	Yzerman									
	Jr. Z-ABS	Yzerman Jr									
	Y-ABS			Shanahan							
	Jr. Y-ABS			Shanahan Jr							

	Model Modèle	Stiffness (lb/in) (GM) Rigidité	Perf	Wear	Weight Poids	Length Longueur	Material Matériau
COMPOSITE STICKS	Synergy Si-Core Iginla	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Si-Core Lidstrom	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Si-Core Sakic	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Si-Core Shanahan	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Si-Core Modano	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Si-Core Drury	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 110 Grip Iginla	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 110 Grip Lidstrom	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 110 Grip Sakic	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 110 Grip Shanahan	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 110 Grip Modano	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 110 Grip Drury	110 XX-Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Iginla	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Lidstrom	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Sakic	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Shanahan	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Modano	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Grip Drury	100 Stiff Flex	10	9	455	56	Graphite/Aramid/Grip
	Synergy 100 Iginla	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 100 Lidstrom	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 100 Sakic	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 100 Shanahan	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 100 Modano	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 100 Drury	100 Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Iginla	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Lidstrom	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Sakic	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Shanahan	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Modano	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy 85 Drury	85 M-Stiff Flex	10	9	450	56	Graphite/Aramid
	Synergy Grip 75 Modano	75 M-Stiff Flex	10	9	420	54	Graphite/Aramid/Grip
	Synergy Grip 75 Sakic	75 M-Stiff Flex	11	9	420	54	Graphite/Aramid/Grip
	Synergy 75 Modano	75 M-Stiff Flex	10	9	415	54	Graphite/Aramid
	Synergy 75 Sakic	75 M-Stiff Flex	10	9	415	54	Graphite/Aramid
	Jr. Synergy Grip 50 Modano	50 Stiff Flex	10	9	325	47	Aramid/Carbon/Glass/Grip
	Jr. Synergy Grip 50 Yzerman	50 Stiff Flex	10	9	325	47	Aramid/Carbon/Glass/Grip
	Jr. Synergy 50 Modano	50 Stiff Flex	10	9	320	47	Aramid/Carbon/Glass
	Jr. Synergy 50 Yzerman	50 Stiff Flex	10	9	320	47	Aramid/Carbon/Glass
	Synthesis Grip 110	110 XX-Stiff Flex	10	9	305	52	Graphite/Aramid/Grip
	Synthesis Grip 100	100 Stiff Flex	10	9	305	52	Graphite/Aramid/Grip
	Synthesis 100	100 Stiff Flex	10	9	300	52	Graphite/Aramid
	Synthesis 85	85 M-Stiff Flex	10	9	300	52	Graphite/Aramid
SENIOR SHAFTS	Z-Bubble 110 Grip	110 XX-Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z-Bubble 100 Grip	100 Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z-Bubble 85 Grip	85 M-Stiff Flex	9	8	280	50	Graphite/Aramid/Grip
	Z-Bubble 110	110 XX-Stiff Flex	9	8	275	50	Graphite/Aramid
	Z-Bubble 100	100 Stiff Flex	9	8	275	50	Graphite/Aramid
	Z-Bubble 85	85 M-Stiff Flex	9	8	275	51	Graphite/Aramid
	Ultra Lite 110	110 XX-Stiff Flex	9	9	290	50	Graphite/Aramid
	Ultra Lite 100	100 Stiff Flex	9	9	290	50	Graphite/Aramid
	Ultra Lite 85	85 M-Stiff Flex	9	9	290	50	Graphite/Aramid
	Grip Lite 110	110 XX-Stiff Flex	8.5	8.5	300	50	Graphite/Aramid/Grip
	Grip Lite 100	100 Stiff Flex	8.5	8.5	300	50	Graphite/Aramid/Grip
	Typhoon 80	80 M-Stiff Flex	7	7.5	340	50	Graphite/Glass
	Ultra Carbon	100 Stiff Flex	6.5	7	340	50	Carbon/Glass
	E-Flex Yzerman Composite	80 M-Stiff Flex	6	6	380	50	Carbon/Glass
INT. SHAFTS	Synthesis 75	75 M-Stiff Flex	10	9	275	50	Graphite/Aramid
	Z-Bubble 75 Grip	75 M-Stiff Flex	9	8	265	50	Graphite/Aramid/Grip
	Z-Bubble 75	75 M-Stiff Flex	9	8	260	50	Graphite/Aramid
	Cyclone Graphite 95	95 Stiff Flex	9.5	8	270	50	Graphite/Aramid
	Cyclone Graphite 70	70 M-Stiff Flex	9.5	8	270	50	Graphite/Aramid
	Typhoon 70	70 M-Stiff Flex	7	7	320	50	Graphite/Glass
JUNIOR	Jr. Synthesis 50	50 Stiff Flex	10	9	210	45	Graphite/Aramid/Glass
	Jr. Z-Bubble Grip 50	50 Stiff Flex	9	8	200	43	Aramid/Glass/Grip
	Jr. Z-Bubble 50	50 Stiff Flex	9	8	195	43	Aramid/Glass
	Jr. Ultra Lite 55	55 Stiff Flex	8.5	8	200	43	Aramid/Glass
	Jr. Typhoon 45	45 M-Stiff Flex	7	7.5	215	43	Carbon/Glass
	Jr. Ultra Carbon	60 Stiff Flex	6	7	250	43	Carbon/Glass
	Jr. E-Flex Yzerman Composite	M-Stiff Flex	6	6	235	43	Carbon/Glass
	Y-15 Composite	45 M-Stiff Flex	6	6	250	35	Carbon/Glass

EASTON 2003 product catalog

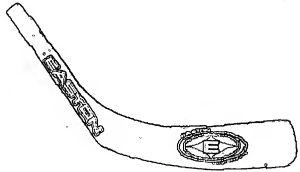
7855 Haskell Avenue / Suite 200 / Van Nuys / California / 91406 P - 818.782.6445 / 800.347.3901 / F - 800.800.8734 www.eastonhockey.com

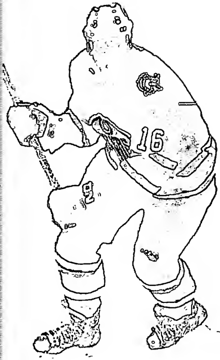

EASTON

» Ultra Graphite (Canada Only) «

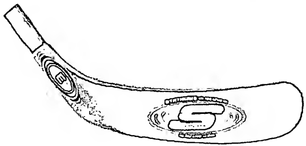
Sku: A119202 Yzerman A119312 Sakic A119310 Modano A119201 Lidstrom A119111 Shanahan

Features:	Features:
· Graphite interlock braided sock	- Douille tressée de graphite à enclenchement
· 200 grams	- 200 grammes





Mike York · Edmonton Oilers



» Synthesis Intermediate «

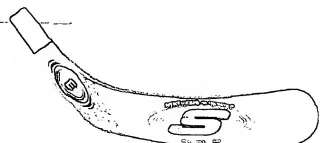
Sku: A119342 Sakic, A119343 Modano A119347 Iginla

Features:	Features:
Low-kick blade design	· Design avec point de frappe bas
Pro-spec carbon construction	Fabrication a base de carbone Pro-spec
Proprietary structural design	Design structurel unique
Ultra thin blade geometry	· Géométrie de la lame ultra-mince
140 grams	140 grammes

» Synthesis Jr. «

Sku: A119246 Yzerman Jr A119245 Modano Jr A119248 Iginla Jr

Features:	Features:
Low-kick blade design	- Design avec point de frappe bas
· Pro-spec carbon construction	- Fabrication à base de carbone Pro-spec
· Proprietary structural design	- Design structurel unique
Ultra thin blade geometry	- Géométrie de la lame ultra-mince
110 grams	110 grammes



» Hybrid Synthesis «

» Hybrid Synthesis «

Sku: A119331 Yzerman_A119334 Sakic_A119330 Modano_A119333 Shanahan_A119332 Drury

Features:
- » 100% graphite blade construction
- » Low-kick blade design
- » New. 360 degree Lock joint
- » Mylar reinforced fiber braid
- » EPX-T hybrid hosel
- » 160 grams

Features:
- » Lame fabriquée de graphite à 100%
- » Design avec point de frappe bas
- » Nouveau! Blocage du joint à 360 degrés
- » Tresse de fibres renforcée au Mylar
- » Tuyau hybride EPX-T
- » 160 grammes

» Hybrid Lami «

Sku: A119350 Yzerman_A119351 Sakic_A119348 Modano_A119349 Shanahan_A119347 Drury

Features:
- » 100% graphite blade construction
- » New. 360 degree Lock joint
- » Mylar reinforced fiber braid
- » EPX multi-lami hosel
- » 175 grams

Features:
- » Lame fabriquée de graphite à 100%
- » Nouveau! Blocage du joint à 360 degrés
- » Tresse de fibres renforcée au Mylar
- » Tuyau multi laminé EXP
- » 175 grammes

» Hybrid Pro, Hybrid Jr. «

Hybrid Pro Sku: A119355 Yzerman_A119356 Sakic_A119353 Modano_A119354 Shanahan
Hybrid Jr. Sku: A119358 Yzerman Jr._A119357 Modano Jr.

Features:
- » 100% graphite blade construction
- » New. 360 degree Lock joint
- » Mylar reinforced fiber braid
- » High grade hickory hosel
- » 195 grams/165 grams Jr.

Features:
- » Lame fabriquée de graphite à 100%
- » Nouveau! Blocage du joint à 360 degrés
- » Tresse de fibres renforcée au Mylar
- » Tuyau de noyer de haute qualité
- » 195 grammes/165 grammes

» Fibre Plus «

Sku: A119154 Sakic_A119164 Modano_A119117 Shanahan

Features:
- » Handcrafted
- » 525-K Aramid system
- » Graphite/glass hosel

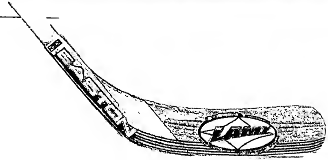
Features:
- » Fait à la main
- » Système à base d'aramide 525K
- » Tuyau à base de graphite et de verre

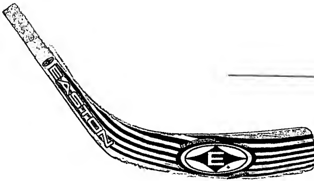
» Lami «

Sku: A119156 Yzerman_A119163 Modano_A119155 Lidstrom_A119121 Shanahan

Features:
- » Handcrafted
- » Wood 525-10 system
- » EPX multi-lami hosel

Features:
- » Fait à la main
- » Système de bois 525-10
- » Tuyau multi laminé EXP





» Pro, Pro Jr. «

Pro Sku: A119149 Yzerman_A119165 Sakic_A119162 Modano_A119145 Lidstrom_A119123 S[illegible]han
Pro Jr. Sku: A119150 Yzerman Jr._A119146 Sakic Jr._A119168 Modano Jr._A119102 Shanahan Jr.

Features:
- » Handcrafted
- » High grade hickory hosel

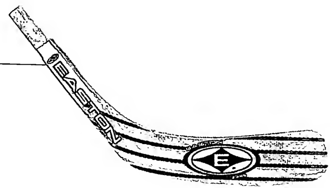
Features:
- » Fait à la main
- » Tuyau de noyer de haute qualité

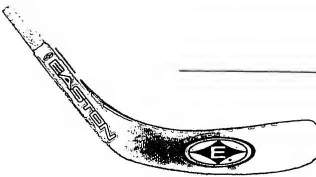
» Z-ABS, Z-ABS Jr. «

Z-ABS Sku: A119136 Yzerman
Z-ABS Jr. Sku: A119135 Yzerman Jr.

Features:
- » Wood/ABS hybrid
- » High grade hickory hosel

Features:
- » Hybride de bois et de ABS
- » Tuyau de noyer de haute qualité





» X-ABS, X-ABS Jr. «

X-ABS Sku: A119130 Shanahan
X-ABS Jr. Sku: A119105 Shanahan Jr.

Features:
- » ABS/fiber paddle
- » High grade hickory hosel

Features:
- » Palette de fibres et de ABS
- » Tuyau de noyer de haute qualité

Chris Drury » Buffalo Sabres

Blades

	Series	Mid 9/16 15 mm Lie 6	Heel 1/2 12 mm Lie 5.5	Toe 3/4 18 mm Lie 6	Mid 1/2 12mm Lie 5.5	Mid-Heel 3/8 9mm Lie 5	Heel 1/2 12 mm Lie 5.5	Mid 1/2" 12mm Lie 5.5
Composite	Synthesis Si-Core Sr.		Lidstrom		Sakic	Modano		Iginla
	Synthesis Sr.	Yzerman	Lidstrom	Shanahan	Sakic	Modano	Drury	Iginla
	Synthesis Int.				Sakic	Modano	Drury	
	Synthesis Jr.	Yzerman Jr.				Modano Jr.		Iginla Jr.
	2-Carbon Si-Core		Lidstrom		Sakic	Modano		Iginla
	2-Carbon	Yzerman	Lidstrom	Shanahan	Sakic	Modano	Drury	
	Jr. 2-Carbon	Yzerman Jr.				Modano Jr.		Iginla Jr.
	Havoc		Lidstrom		Sakic	Modano		Iginla
	Ultra Lite	Yzerman	Lidstrom	Shanahan	Sakic	Modano		
	Jr. Ultra Lite	Yzerman Jr.						
	Ultra Graphite	Yzerman	Lidstrom	Shanahan	Sakic	Modano		
Hybrid/Wood	Hybrid Synthesis RB	Yzerman		Shanahan	Sakic	Modano	Drury	
	Hybrid Lami RB	Yzerman		Shanahan	Sakic	Modano	Drury	
	Hybrid Pro RB	Yzerman		Shanahan	Sakic	Modano		
	Jr. Hybrid Pro RB	Yzerman Jr.				Modano Jr.		
	RB Fiber Plus			Shanahan	Sakic	Modano		
	RB Lami	Yzerman	Lidstrom	Shanahan		Modano		
	RB Pro	Yzerman	Lidstrom	Shanahan	Sakic	Modano		
	Jr. RB Pro	Yzerman Jr.		Shanahan Jr	Sakic Jr.	Modano Jr.		
ABS	2-ABS	Yzerman						
	Jr. 2-ABS	Yzerman Jr.						
	X-ABS			Shanahan				
	Jr. X-ABS			Shanahan Jr.				

Hybrid/Wood Sticks

Model Modèle	Stiffness (lb/in) Rigidité	Curve	Length Longueur	Material Matériau
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Lidstrom	63	Carbon/Glass Laminate
2-Carbon 110 Hybrid	110 XX-Stiff Flex	Sakic	63	Carbon/Glass Laminate
2-Carbon 110 Hybrid	110 XX-Stiff Flex	Yzerman	63	Carbon/Glass Laminate
2-Carbon 110 Hybrid	110 XX-Stiff Flex	Drury	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Shanahan	63	Carbon/Glass Laminate
Z-Carbon 110 Hybrid	110 XX-Stiff Flex	Modano	63	Carbon/Glass Laminate
2-Carbon 100 Hybrid	100 Stiff Flex	Lidstrom	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Sakic	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Yzerman	61	Birch Veneer/Glass Laminate
2-Carbon 100 Hybrid	100 Stiff Flex	Drury	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Shanahan	61	Birch Veneer/Glass Laminate
Z-Carbon 100 Hybrid	100 Stiff Flex	Modano	61	Birch Veneer/Glass Laminate
2-Carbon 95 Hybrid	95 Stiff Flex	Lidstrom	60	Glass Laminate
2-Carbon 95 Hybrid	95 Stiff Flex	Sakic	60	Glass Laminate
2-Carbon 95 Hybrid	95 Stiff Flex	Yzerman	60	Glass Laminate
2-Carbon 95 Hybrid	95 Stiff Flex	Modano	60	Glass Laminate
2-Carbon 70 Hybrid	70 M-Stiff Flex	Modano	60	Glass Laminate
2-Carbon 70 Hybrid	70 M-Stiff Flex	Yzerman	60	Glass Laminate
2-Carbon 65 Hybrid	65 Stiff Flex	Modano	53	Carbon/Glass Lamina[illegible]
2-Carbon 50 Hybrid	50 M-Stiff Flex	Modano	53	Glass Laminate
2-Carbon 50 Hybrid	50 M-Stiff Flex	Yzerman	53	Glass Laminate
Ultra Lite	105 X Stiff LFex	Modano	60	Box Core Laminate
Ultra Lite	105 X Stiff LFex	Sakic	60	Box Core Laminate
Ultra Lite	105 X Stiff LFex	Lidstrom	60	Box Core Laminate
Fibre Lite	100 Stiff Flex	Modano	60	Glass Molded
Fibre Lite	100 Stiff Flex	Shanahan	60	Glass Molded
Fibre Lite	100 Stiff Flex	Sakic	60	Glass Molded
Fibre Lite	100 Stiff Flex	Lidstrom	60	Glass Molded
Classic	95 Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic	95 Stiff Flex	Sakic	58.5	Aspen Core/Aircraft Venee
Classic	95 Stiff Flex	Shanahan	58.5	Aspen Core/Aircraft Veneer
Classic	95 Stiff Flex	Modano	58.5	Aspen Core/Aircraft Veneer
Classic Intermediate	70 M-Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic Jr Pro	65 Stiff Flex	Iginla	52	Aspen Core/Aircraft Veneer
Classic Jr.	60 M-Stiff Flex	Yzerman	52	13-ply Horiz
Classic Jr.	60 M-Stiff Flex	Iginla	52	13-ply Horiz
Classic Youth	45 M-Stiff Flex	Yzerman	45	13-ply Vert
Classic Z-ABS	95 Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic X ABS	95 Stiff Flex	Yzerman	58.5	Aspen Core/Aircraft Veneer
Classic X-ABS Jr.	60 M Stiff Flex	Yzerman	52	Aspen Core/Aircraft Veneer
Ultra ABS	Power Flex	Shanahan	50	ABS Wood
Ultra ABS Jr.	Power Flex	Shanahan	52	ABS Wood
Ultra ABS Youth	Power Flex	Shanahan	45	13-ply Vert

Gloves

Product/ Produit	Model/ Modèle	Height 3'4"-3'8"	3'8"-4'	4'-4'4"	4'4"-4'8"	4'8"-5'4"	5'4"-6'	6'+
Gloves	Synergy					14"	15"	
Gloves	Air		11"	12"	13"	14"	15"	16"
Gloves	Ultra Lite Pro			12"	13"	16"	15"	
Gloves	Ultra Lite	10"	11"	12"	13"	16"	15"	
Gloves	X-Treme			12"	13"	16"	15"	
Gloves	Synergy YTH	9"	10" & 11"				15"	
Gloves	Octane			12"	13"	14"	15"	

Pants

Product/ Produit	Model/ Modèle	XXS / TTP	XS / TP	S / P	M / M	L / G	XL / TG
Pants	Synergy		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Air		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Air Junior		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	Air Women	44 (26"-28")	46 (29"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Ultra Lite		46 (28"-30")	49 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Ultra Lite Jr.		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	X-Treme		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	X-Treme Jr.		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	Octane		46 (28"-30")	48 (30"-32")	50 (32"-34")	52 (34"-36")	54 (36"-38")
Pants	Octane Jr.		100 (22"-24")	120 (24"-26")	140 (26"-28")	160 (28"-30")	180 (30"-32")
Pants	Synergy YTH			(20"-22")	(22"-24")	(24"-26")	(28"-30")
Pants	Referee				(32"-34")	(34"-36")	(36"-38")

Elbow Pads

Product/ Produit	Model/ Modèle	Height 3'4"-4'	4'-4'10"	4'10"-5'6"	5'4"-6'	5'8"-6'4"	6'+
Elbow Pad	Synergy			S	S-L	S-L	L
Elbow Pad	Air		Jr. S	Jr. L-S	S-L	S-L	L
Elbow Pad	Ultra Lite		Jr. S	Jr. L-S	S-L	S-L	L
Elbow Pad	X-Treme		Jr. S	Jr. L-S	S-L	S-L	L
Elbow Pad	X-Treme Classic	S-L-YTH	Jr. S	Jr. L-S			
Elbow Pad	Octane		Jr. S	Jr. L-S	S-L	S-L	L
Elbow Pad	Synergy YTH	S-M-L					

Shoulder Pads

Product/ Produit	Model/ Modèle / Chest Size	Height 3'4"-4' / 24"-28"	4'-4'10" / 28"-32"	4'10"-5'6" / 32"-36"	5'4"-6' / 36"-40"	5'8"-6'4" / 40"-44"	6'+ / 44"+
Shoulder Pad	Synergy			S	S-M	M-L	XL
Shoulder Pad	Air		Jr. S-Jr. M	Jr. L-S	S-M	M-L	XL
Shoulder Pad	Ultra Lite		Jr. S-Jr. M	Jr. L-S	S-M	M-L	XL
Shoulder Pad	X-Treme		Jr. S-Jr. M	Jr. L-S	S-M	M-L	XL
Shoulder Pad	Classic				S-M	M-L	XL
Shoulder Pad	Octane		Jr. S-Jr. M	Jr. L-S	S-M	M-L	XL
Shoulder Pad	Synergy YTH	S-M-L	L				

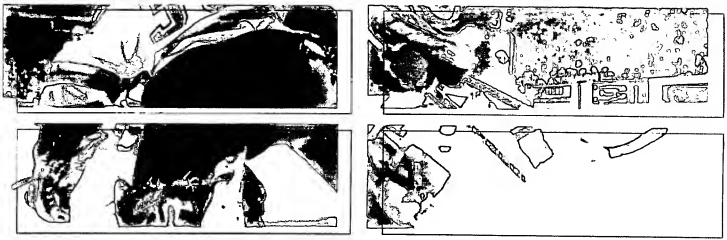
Wood Stick Curves

Series	Mid 9/16 15 mm Lie 6	Heel 1/2 12 mm Lie 5.5	Toe 3/4 18 mm Lie 6	Mid 1/2 12 mm Lie 5.5	Mid-Heel 3/8 9mm Lie 5	Mid 3/8 9mm Lie 5	Heel 1/2 12mm Lie 5.5	Mid 1/2 12mm Lie 4
2-Carbon 110	Yzerman	Lidstrom	Shanahan	Sakic	Modano		Drury	
2-Carbon 100	Yzerman	Lidstrom	Shanahan	Sakic	Modano		Drury	
2-Carbon 95	Yzerman	Lidstrom		Sakic	Modano			
2-Carbon 70	Yzerman				Modano		Drury	
2-Carbon 65					Modano			
2-Carbon 50	Yzerman				Modano			
Ultra Lite		Lidstrom		Sakic	Modano			
Fibre Lite		Lidstrom	Shanahan	Sakic	Modano			
Classic	Yzerman		Shanahan	Sakic	Modano			Iginla
Classic Inter.	Yzerman							
Classic Jr. Pro								Iginla
Classic Jr.	Yzerman							Iginla
Classic Youth	Yzerman							
Classic 2-ABS	Yzerman							
Classic X ABS	Yzerman							
Classic X ABS Jr.	Yzerman							
Ultra ABS			Shanahan					
Ultra ABS Jr.			Shanahan					
Ultra ABS Youth			Shanahan					

Shin Guards

Product/ Produit	Model/ Modèle	Height 3'4"-3'8"	3'8"-4'	4'-4'4"	4'4"-4'8"	4'8"-5'	5'-5'4"	5'4"-5'8"	5'8"-6'	6'-6'4"	6'4"+
Shin Guard	Synergy							14"	15"	16"	
Shin Guard	Air			10"	11"	12"	13"	14"	15"	16"	
Shin Guard	Ultra Lite			10"	11"	12"	13"	14"	15"	16"	17"
Shin Guard	X-Treme			10"	11"	12"	13"	14"	15"	16"	17"
Shin Guard	Octane			10"	11"	12"	13"	14"	15"	16"	
Shin Guard	Synergy YTH	8"	9"	10"	11"	12"					

The U.S. Hockey Stick & Replacement Blade Market



Sales for the 2003 Season

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The U.S. Hockey Stick & Replacement Blade Market

Sales for the 2003 Season

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April 2004

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Methodology and Supplier Participation List

The Market Research Group of Rennie Media Inc. circulated questionnaires to all key suppliers of hockey sticks, replacement blades and goalie sticks sold in the U.S. market. Suppliers were asked to provide data on stick and blade sales delivered during the 2003 calendar year (January 1st to December 31st, 2003). Shipment data includes product shipped to U.S. retail accounts only and is reported in U.S. dollars.

Suppliers returned each "individual company" questionnaire to Gaviller & Company LLP Chartered Accountants. The accounting firm consolidated all "individual company" data into an industry wide report. This report was annotated and published by Rennie Media Inc. on April 19, 2004.

This report is presented in a format that allows participating companies to calculate their market share in various stick and blade categories. Each company can also compare their average costs with the industry-wide averages. And finally, 2003 sales are compared with 2002 sales.

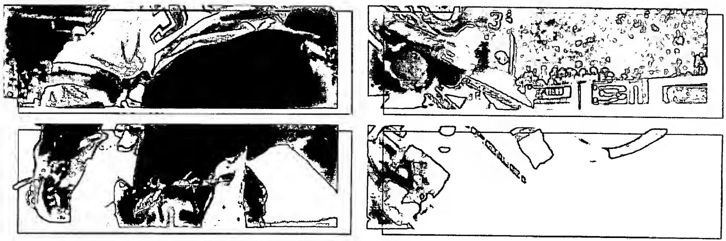
2003 Participating Suppliers

1. Bauer Nike Hockey USA Inc
2. Brian's Custom Pro Mfg
3. Easton Sports
4. Hespeler Hockey
5. Innovative Hockey Inc
6. ITECH Sport Products Inc
7. Mission Hockey
8. Montreal Hockey Co
9. Sherwood-Drolet Corp. Ltd
10. The Hockey Company
11. TPS Hockey

2002 Participating Suppliers

1. Bauer Nike Hockey USA Inc
2. Brian's Custom Pro Mfg
3. Easton Sports
4. Franklin Sports
5. Hespeler Hockey
6. Innovative Hockey Inc
7. ITECH Sport Products Inc
8. Louisville Hockey
9. Mission Hockey
10. Montreal Hockey Co
11. Rocket Hockey
12. Sonde Hockey Inc
13. Sherwood-Drolet Corp. Ltd
14. The Hockey Company
15. Vic Hockey

Sales Summary



Total Sales Shipped January 1, 2003 Through December 31, 2003

(reported in U.S. dollars)

	Dollar Sales		Dollar Market Share	
	2003 Total Sales	Our 2003 Total Sales	2003 Total Sales	Our 2003 Total Sales
Hockey Sticks and Shafts				
Adult Wood Sticks	$ 9,004,132		11.2%	
Junior/Youth Wood Sticks	3,437,527		4.2%	
Adult Graphite or Composite Sticks	32,017,473		39.6%	
Junior Graphite or Composite Sticks	7,785,715		9.7%	
Adult Graphite or Composite Shafts	10,441,404		13.0%	
Junior Graphite or Composite Shafts	2,156,550		2.7%	
Adult Aluminum Sticks	Nil		0.0%	
Junior Aluminum Sticks	Nil		0.0%	
Adult Aluminum Shafts	N/A		N/A	
Junior Aluminum Shafts	N/A		N/A	
TOTAL	**$ 64,822,801**		**80.4%**	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Replacement Blades					
Composite	$	6,787,624		8.4%	
Senior (fiberglass-reinforced hosel)		2,772,516		3.4%	
Senior (hosel not reinforced-reinforced)		1,272,773		1.6%	
Junior (with and without reinforced hosels)		1,015,109		1.3%	
PVC		NIL		0.0%	
TOTAL	**$**	**11,848,022**		**14.7%**	
Goalie Sticks					
Foam Core Sticks	$	2,811,562		3.5%	
All Other Senior Sticks		770,025		1.0%	
All Other Intermediate Sticks		119,728		0.1%	
All Other Junior Sticks		238,311		0.3%	
TOTAL	**$**	**3,945,626**		**4.9%**	
TOTAL U.S. MARKET	**$**	**80,616,449**		**100.0%**	

2003 Sales Compared to 2002 Sales
(reported in U.S. dollars)

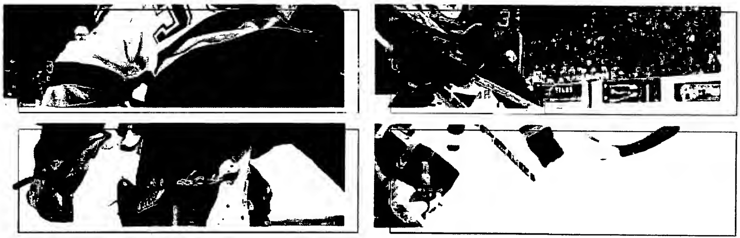
	Dollar Sales			Dollar Market Share		
	2003 Total Sales	2002 Total Sales	Change	2003 Total Sales	2002 Total Sales	Change
Hockey Sticks and Shafts						
Adult Wood Sticks	$ 9,004,132	$ 12,865,326	- 30.0%	11.2%	18.5%	- 7.3%
Junior/Youth Wood Sticks	3,417,527	5,027,644	- 32.0%	4.2%	7.2%	- 3.0%
Adult Graphite or Composite Sticks	32,017,473	18,556,847	+ 72.5%	39.6%	26.7%	+ 12.9%
Junior Graphite or Composite Sticks	7,785,715	2,961,666	+ 162.9%	9.7%	4.3%	+ 5.4%
Adult Graphite or Composite Shafts	10,441,404	11,990,257	- 12.9%	13.0%	17.2%	- 4.2%
Junior Graphite or Composite Shafts	2,156,550	1,796,568	+ 20.0%	2.7%	2.6%	+ 0.1%
Adult Aluminum Sticks	NIL	N/A	No change	0.0%	0.0%	No change
Junior Aluminum Sticks	NIL	N/A	No change	0.0%	0.0%	No change
Adult Aluminum Shafts	N/A	N/A	N/A	N/A	N/A	N/A
Junior Aluminum Shafts	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**$ 64,822,801**	**$ 53,198,508**	**+ 21.9%**	**80.4%**	**76.5%**	**+ 3.9%**
Replacement Blades						
Composite	$ 6,787,624	$ 4,235,587	+ 60.3%	8.4%	6.1%	+ 2.3%
Senior (fiberglass-reinforced hosel)	2,772,516	3,947,314	- 29.8%	3.4%	5.7%	- 2.3%
Senior (hosel not reinforced-reinforced)	1,272,773	2,363,903	- 46.2%	1.6%	3.4%	- 1.8%
Junior (with and without reinforced hosels)	1,015,109	1,827,089	- 44.4%	1.3%	2.6%	- 1.3%
PVC	NIL	NIL	No change	0.0%	0.0%	No change
TOTAL	**$ 11,848,022**	**$ 12,373,893**	**- 4.2%**	**14.7%**	**17.8%**	**- 3.1%**
Goalie Sticks						
Foam Core Sticks	$ 2,811,562	$ 2,566,473	+ 9.5%	3.5%	3.6%	- 0.1%
All Other Senior Sticks	776,025	1,072,415	- 27.6%	1.0%	1.5%	- 0.5%
All Other Intermediate Sticks	119,728	39,615	+ 202.2%	0.1%	0.1%	No change
All Other Junior Sticks	238,311	319,805	- 25.5%	0.3%	0.5%	- 0.2%
TOTAL	**$ 3,945,626**	**$ 3,998,308**	**- 1.3%**	**4.9%**	**5.7%**	**- 0.8%**
TOTAL U.S. MARKET	**$ 80,616,449**	**$ 69,570,709**	**+ 15.9%**	**100.0%**	**100.0%**	

Historical Sales Summary
(reported in U.S. dollars)

	2003 Total Sales	2002 Total Sales	2001 Total Sales	2000 Total Sales	1999 Total Sales	Change (1)
Hockey Sticks and Shafts						
Adult Wood Sticks	$ 9,004,132	$ 12,865,326	$ 16,585,168	$ 17,204,257	$ 18,518,273	30.0%
Junior/Youth Wood Sticks	3,417,527	5,027,644	5,524,782	5,569,505	5,113,333	- 32.0%
Adult Graphite or Composite Sticks	32,017,473	18,556,847	2,982,726	3,109,885	3,866,490	+ 72.5%
Junior Graphite or Composite Sticks	7,786,715	2,961,866	2,019,230	1,754,637	2,021,939	+ 162.9%
Adult Graphite or Composite Shafts	10,441,404	11,990,257	12,156,764	10,782,717	12,618,475	12.9%
Junior Graphite or Composite Shafts	2,156,550	1,796,568	1,947,474	1,778,845	1,486,398	+ 20.0%
Adult Aluminum Sticks & Shafts	N/A	N/A	251,010	413,176	646,498	N/A
Junior Aluminum Sticks & Shafts	N/A	N/A	34,337	191,358	334,643	N/A
TOTAL	**$ 64,822,801**	**$ 53,198,508**	**$ 41,501,491**	**$ 40,604,380**	**$ 44,606,039**	**+ 21.9%**
Replacement Blades						
Composite	$ 6,787,624	$ 4,235,587	$ 1,179,007	$ 2,110,093	$ 1,611,310	+ 60.3%
Senior (fiberglass-reinforced hosel)	2,772,516	3,947,314	3,716,573	6,694,774	7,652,146	29.8%
Senior (hosel not reinforced-reinforced)	1,272,773	2,363,903	945,914	2,985,744	2,381,286	46.2%
Junior (with and without reinforced hosels)	1,015,109	1,827,089	1,098,586	1,671,614	1,338,983	44.4%
PVC	NIL	NIL	N/A	N/A	77,116	No change
TOTAL	**$ 11,848,022**	**$ 12,373,893**	**$ 6,940,080**	**$ 13,462,225**	**$ 13,260,851**	**- 4.2%**
Goalie Sticks						
Foam Core Sticks	$ 2,811,562	$ 2,566,473	$ 2,078,058	$ 1,158,459	$ N/A	+ 9.5%
All Other Senior Sticks	776,025	1,072,415	1,426,359	1,630,507	3,337,438	27.6%
All Other Intermediate Sticks	119,728	39,615	245,862	164,643	291,644	+ 202.2%
All Other Junior Sticks	238,311	319,805	416,955	329,710	378,342	25.5%
TOTAL	**$ 3,945,626**	**$ 3,998,306**	**$ 4,167,234**	**$ 3,283,319**	**$ 4,007,419**	**- 1.3%**
TOTAL U.S. MARKET	**$ 80,616,449**	**$ 69,570,709**	**$ 52,608,805**	**$ 57,549,924**	**$ 61,874,309**	**+ 15.9%**

Note
(1) 2003 sales compared to 2002 sales

Hockey Stick & Shaft Sales



- Conventional Wood Sticks
- Graphite or Composite Sticks and Shafts
- Aluminum Sticks and Shafts

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Adult Sticks With Wood/Graphite/Fiberglass Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$18 and over	59,444			$ 1,409,358			$ 23.71	
Under $18	60,371			931,656			15.43	
TOTAL	**119,815**			**$ 2,341,014**			**$ 19.54**	

Adult Sticks With Wood/Fiberglass Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$17 and over	39,174			$ 770,881			$ 19.68	
$15 to $16.99	44,246			699,643			15.81	
Under $15	74,847			817,027			10.92	
TOTAL	**158,267**			**$ 2,287,551**			**$ 14.45**	

Adult Sticks With All Wood Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry Wide Average Cost	Our Average Cost
$10 and over	189,032			$ 2,613,574			$ 13.83	
$8 to $9.99	82,289			695,027			8.45	
Under $8	166,093			1,066,966			6.42	
TOTAL	**437,414**			**$ 4,375,567**			**$ 10.00**	

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Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Total Adult Wood Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	715,496			$ 9,004,132			$ 12.58	

Junior/Youth Sticks With Wood/Graphite/Fiberglass Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
All prices	25,862			$ 277,381			$ 10.73	

Junior/Youth Sticks With Wood/Fiberglass Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$10 and over	29,339			$ 360,760			$ 12.30	
$8 to $9.99	13,715			115,844			8.45	
Under $8	12,702			70,444			5.55	
TOTAL	55,756			$ 547,048			$ 9.81	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Junior/Youth Sticks With All Wood Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$5 and over	317,457			$ 2,312,989			$ 7.29	
Under $5	65,847			280,109			4.25	
TOTAL	383,304			$ 2,593,098			$ 6.77	

Total Junior/Youth Wood Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	464,922			$ 3,417,527			$ 7.35	

Total All Conventional Wood Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	1,180,418			$ 12,421,659			$ 10.52	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Adult Graphite or Composite Full Sticks
(shaft & blade combos and one-piece sticks)

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$75 and over	320,015			$ 30,074,835			$ 93.98	
$50 to $74.99	14,028			860,925			61.37	
$35 to $49.99	12,029			491,482			40.86	
Under $35	26,425			590,231			22.34	
TOTAL	372,497			$ 32,017,473			$ 85.95	

Junior Graphite or Composite Full Sticks
(shaft & blade combos and one-piece sticks)

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$25 and over	98,456			$ 7,484,011			$ 76.01	
Under $25	18,443			301,704			16.36	
TOTAL	116,899			$ 7,785,716			$ 66.60	

Total Graphite or Composite Full Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	489,396			$ 39,803,188			$ 81.33	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Adult Graphite or Composite Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$60 and over	105,254			$ 6,785,659			$ 64.47	
$45 to $59.99	58,749			3,009,980			51.24	
$30 to $44.99	14,938			500,622			33.51	
Under $30	9,036			145,143			16.06	
TOTAL	187,976			$ 10,441,404			$ 56.66	

Junior Graphite or Composite Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
All prices	70,011			$ 2,156,550			$ 30.80	

Total Graphite or Composite Shafts

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	257,987			$ 12,597,954			$ 48.83	

Total All Graphite or Composite Sticks and Shafts

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	747,383			$ 52,401,142			$ 70.11	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Adult Aluminum Full Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$45 and over	NIL			$ NIL			$ N/A	
$35 to $44.99	NIL			NIL			N/A	
Under $35	NIL			NIL			N/A	
TOTAL	NIL			$ NIL			$ N/A	

Junior Aluminum Full Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$25 and over	NIL			$ NIL			$ N/A	
Under $25	NIL			NIL			N/A	
TOTAL	NIL			$ NIL			$ N/A	

Total Aluminum Full Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	NIL			$ NIL			$ N/A	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Adult Aluminum Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$25 and over	N/A			$ N/A			$ N/A	
Under $25	N/A			N/A			N/A	
TOTAL	N/A			$ N/A			$ N/A	

Junior Aluminum Shafts

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
All prices	N/A			$ N/A			$ N/A	

Total Aluminum Shafts

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	N/A			$ N/A			$ N/A	

Total Aluminum Sticks and Shafts

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	N/A			$ N/A			$ N/A	

Summary of 2003 Hockey Stick & Shaft Sales

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
Total Adult Wood Sticks	715,496	________	________	$ 9,004,102	________	________	$ 12.58	________
Total Junior/Youth Wood Sticks	464,932	________	________	3,417,527	________	________	7.35	________
Total Adult Graphite or Composite Sticks	372,497	________	________	32,017,473	________	________	85.95	________
Total Junior Graphite or Composite Sticks	116,889	________	________	7,795,716	________	________	66.69	________
Total Adult Graphite or Composite Shafts	187,976	________	________	10,441,404	________	________	55.55	________
Total Junior Graphite or Composite Shafts	70,011	________	________	2,156,660	________	________	30.80	________
Total Adult Aluminum Sticks	NIL	________	________	NIL	________	________	N/A	________
Total Junior Aluminum Sticks	NIL	________	________	NIL	________	________	N/A	________
Total Adult Aluminum Shafts	N/A	________	________	N/A	________	________	N/A	________
Total Junior Aluminum Shafts	N/A	________	________	N/A	________	________	N/A	________
TOTAL	1,927,801	________	________	$ 64,822,801	________	________	$ 33.63	________

2003 Sales Compared to 2002 Sales

Adult Sticks With Wood/Graphite/Fiberglass Shafts

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$18 and over	59,444	110,836	46.4%	$ 1,409,358	$ 2,508,437	43.8%	$ 23.71	$ 22.63	- 4.8%
Under $18	60,371	88,081	31.5%	931,656	1,427,189	34.7%	15.43	16.20	4.8%
TOTAL	**119,815**	**198,917**	- **39.8%**	**$ 2,341,014**	**$ 3,935,626**	- **40.5%**	**$ 19.54**	**$ 19.79**	- **1.3%**

Adult Sticks With Wood/Fiberglass Shafts

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$17 and over	39,174	25,860	+ 51.5%	$ 770,881	$ 484,514	+ 59.1%	$ 19.68	$ 18.74	- 5.0%
$15 to $16.99	44,246	121,392	63.6%	699,643	1,930,781	63.8%	15.81	15.91	0.6%
Under $15	74,847	86,244	13.2%	817,027	1,083,236	24.6%	10.92	12.56	13.1%
TOTAL	**158,267**	**233,496**	- **32.2%**	**$ 2,287,551**	**$ 3,498,531**	- **34.6%**	**$ 14.45**	**$ 14.90**	**3.5%**

Adult Sticks With All Wood Shafts

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$10 and over	189,032	247,886	- 23.7%	$ 2,613,574	$ 3,327,556	- 21.5%	$ 13.83	$ 13.42	- 3.1%
$8 to $9.99	82,289	130,057	- 36.7%	695,027	1,116,540	- 37.8%	8.45	8.59	1.6%
Under $8	166,093	158,045	+ 5.1%	1,066,966	987,073	- 8.1%	6.42	6.25	- 2.7%
TOTAL	**437,414**	**535,988**	- **18.4%**	**$ 4,375,567**	**$ 5,431,169**	- **19.4%**	**$ 10.00**	**$ 10.13**	- **1.3%**

2003 Sales Compared to 2002 Sales

Total All Adult Wood Sticks

	Unit Sales 2003	Unit Sales 2002	Change	Dollar Sales 2003	Dollar Sales 2002	Change	Average Cost 2003	Average Cost 2002	Change
TOTAL	715,496	968,401	- 26.1%	$ 9,004,132	$ 12,865,326	- 30.0%	$ 12.58	$ 13.29	- 5.3%

Junior/Youth Sticks With Wood/Graphite/Fiberglass Shafts

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Change	Dollar Sales 2003	Dollar Sales 2002	Change	Average Cost 2003	Average Cost 2002	Change
All prices	25,862	20,012	+ 29.2%	$ 277,381	$ 272,606	- 2.0%	$ 10.73	$ 13.60	21.1%

Junior/Youth Sticks With Wood/Fiberglass Shafts

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Change	Dollar Sales 2003	Dollar Sales 2002	Change	Average Cost 2003	Average Cost 2002	Change
$10 and over	29,339	62,142	- 52.8%	$ 360,760	$ 728,722	- 50.5%	$ 12.30	$ 11.73	- 4.9%
$8 to $9.99	13,715	18,220	- 24.7%	115,844	171,735	- 32.5%	8.45	9.43	10.4%
Under $8	12,702	7,439	+ 70.7%	70,444	46,140	- 52.7%	5.55	6.20	10.5%
TOTAL	55,756	87,801	- 36.5%	$ 547,048	$ 946,597	- 42.2%	$ 9.81	$ 10.78	- 9.0%

Junior/Youth Sticks With All Wood Shafts

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Change	Dollar Sales 2003	Dollar Sales 2002	Change	Average Cost 2003	Average Cost 2002	Change
$5 and over	317,457	452,689	- 29.9%	$ 2,312,989	$ 3,403,373	- 32.0%	$ 7.29	$ 7.52	- 3.1%
Under $5	65,847	99,177	- 33.6%	280,109	405,608	- 30.9%	4.25	4.09	- 3.9%
TOTAL	383,304	551,866	- 30.5%	$ 2,593,098	$ 3,808,981	- 31.9%	$ 6.77	$ 6.90	- 1.9%

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2003 Sales Compared to 2002 Sales

Total All Junior/Youth Wood Sticks

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	464.922	659.679	- 29.5%	$ 3.417,527	$ 5.027.844	- 32.0%	$ 7.35	$ 7.62	- 3.5%

Total All Conventional Wood Sticks

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	1.180.418	1.628.080	- 27.5%	$ 12,421,659	$ 17,892,970	- 30.6%	$ 10.52	$ 10.98	- 4.3%

2003 Sales Compared to 2002 Sales

Adult Graphite or Composite Full Sticks
(shaft & blade combos and one-piece sticks)

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
$75 and over	320.015	190.396	+ 68.1%	$ 30.074.835	$ 17.493.066	+ 71.9%	$ 93.98	$ 91.88	+ 2.3%
$50 to $74.99	14.028	5.980	+ 134.6%	860.925	401.057	+ 114.7%	61.37	67.07	- 8.5%
$35 to $49.99	12.029	3.632	+ 231.2%	491.482	151.885	+ 223.6%	40.86	41.87	- 2.5%
Under $35	26.425	23.728	+ 11.4%	590.231	510.839	+ 15.5%	22.34	21.53	+ 3.8%
TOTAL	**372.497**	**223.736**	**+ 66.5%**	**$ 32.017.473**	**$ 18.556.847**	**+ 72.5%**	**$ 85.95**	**$ 82.94**	**+ 3.6%**

Junior Graphite or Composite Full Sticks
(shaft & blade combos and one-piece sticks)

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
$25 and over	98.456	35.686	+ 175.9%	$ 7.484.011	$ 2.582.178	+ 189.8%	$ 76.01	$ 72.36	+ 5.0%
Under $25	18.443	21.994	- 16.1%	301.704	379.688	- 20.5%	16.36	17.26	- 5.2%
TOTAL	**116.899**	**57.680**	**+ 102.7%**	**$ 7.785.715**	**$ 2.961.866**	**+ 162.9%**	**$ 66.60**	**$ 51.35**	**+ 29.7%**

Total All Graphite or Composite Full Sticks

	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
TOTAL	489.396	281.416	+ 73.9%	$ 39.803.188	$ 21.518.713	+ 85.0%	$ 81.33	$ 76.47	+ 6.4%

2003 Sales Compared to 2002 Sales

Adult Graphite or Composite Shafts

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002		Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002		Dollar Sales Change	Average Cost 2003	Average Cost 2002		Average Cost Change
$60 and over	105,254	120,310	-	12.5%	$ 6,785,659	$ 7,576,179	-	10.4%	$ 64.47	$ 62.97	-	2.4%
$45 to $59.99	58,748	60,191	-	2.4%	3,009,980	3,139,895	-	4.1%	51.24	52.17	-	1.8%
$30 to $44.99	14,938	29,373	-	49.1%	500,622	1,012,512	-	50.6%	33.51	34.47	-	2.8%
Under $30	9,036	13,840	-	34.7%	145,143	261,671	-	44.5%	16.06	18.91	-	15.1%
TOTAL	**187,976**	**223,714**	**-**	**16.0%**	**$ 10,441,404**	**$ 11,990,257**	**-**	**12.9%**	**$ 55.55**	**$ 53.60**	**+**	**3.6%**

Junior Graphite or Composite Shafts

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002		Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002		Dollar Sales Change	Average Cost 2003	Average Cost 2002		Average Cost Change
All prices	70,011	62,560	+	11.9%	$ 2,156,550	$ 1,796,568	+	20.0%	$ 30.80	$ 28.71	+	7.3%

Total All Graphite or Composite Shafts

	Unit Sales 2003	Unit Sales 2002		Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002		Dollar Sales Change	Average Cost 2003	Average Cost 2002		Average Cost Change
TOTAL	257,987	286,283	-	9.9%	$ 12,597,954	$ 13,786,825	-	8.6%	$ 48.83	$ 48.16	+	1.4%

Total All Graphite or Composite Sticks and Shafts

	Unit Sales 2003	Unit Sales 2002		Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002		Dollar Sales Change	Average Cost 2003	Average Cost 2002		Average Cost Change
TOTAL	747,383	567,698	+	31.7%	$ 52,401,142	$ 35,305,538	+	48.4%	$ 70.11	$ 62.19	+	12.7%

2003 Sales Compared to 2002 Sales

Adult Aluminum Full Sticks

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$45 and over	NIL	NIL	No change	$ NIL	$ NIL	No change	$ N/A	$ N/A	N/A
$35 to $44.99	NIL	NIL	No change	NIL	NIL	No change	N/A	N/A	N/A
Under $35	NIL	NIL	No change	NIL	NIL	No change	N/A	N/A	N/A
TOTAL	**NIL**	**NIL**	**No change**	**$ NIL**	**$ NIL**	**No change**	**$ N/A**	**$ N/A**	**N/A**

Junior Aluminum Full Sticks

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$25 and over	NIL	NIL	No change	$ NIL	$ NIL	No change	$ N/A	$ N/A	N/A
Under $25	NIL	NIL	No change	NIL	NIL	No change	N/A	N/A	N/A
TOTAL	**NIL**	**NIL**	**No change**	**$ NIL**	**$ NIL**	**No change**	**$ N/A**	**$ N/A**	**N/A**

Total All Aluminum Full Sticks

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	**NIL**	**NIL**	**No change**	**$ NIL**	**$ NIL**	**No change**	**$ N/A**	**$ N/A**	**N/A**

2003 Sales Compared to 2002 Sales

Adult Aluminum Shafts

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$25 and over	N/A	N/A	N/A	$ N/A	$ N/A	N/A	$ N/A	$ N/A	N/A
Under $25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**N/A**	**N/A**	**N/A**	**$ N/A**	**$ N/A**	**N/A**	**$ N/A**	**$ N/A**	**N/A**

Junior Aluminum Shafts

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
All prices	N/A	N/A	N/A	$ N/A	$ N/A	N/A	$ N/A	$ N/A	N/A

Total All Aluminum Shafts

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	N/A	N/A	N/A	$ N/A	$ N/A	N/A	$ N/A	$ N/A	N/A

Total All Aluminum Sticks and Shafts

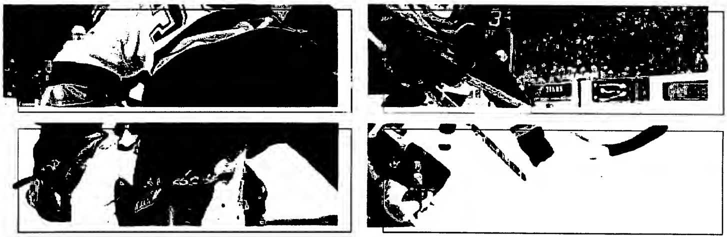
	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	N/A	N/A	N/A	$ N/A	$ N/A	N/A	$ N/A	$ N/A	N/A

Summary of Hockey Stick & Shaft Sales

2003 Sales Compared to 2002 Sales

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
Total Adult Wood Sticks	715.496	968.401	- 26.1%	$ 9.004.132	$ 12.865.326	- 30.0%	$ 12.58	$ 13.29	- 5.3%
Total Junior/Youth Wood Sticks	464.922	659.679	- 29.5%	3.417.527	5.027.644	- 32.0%	7.35	7.62	- 3.5%
Total Adult Graphite or Composite Sticks	372.497	223.735	+ 66.5%	32.017.473	18.556.847	- 72.5%	85.95	82.94	- 3.6%
Total Junior Graphite or Composite Sticks	116.899	57.680	+ 102.7%	7.785.715	2.961.866	- 162.9%	66.60	51.35	- 29.7%
Total Adult Graphite or Composite Shafts	187.976	223.714	- 16.0%	10.441.404	11.990.257	- 12.9%	55.55	52.60	- 5.6%
Total Junior Graphite or Composite Shafts	70.011	62.569	+ 11.9%	2.156.550	1.796.568	- 20.0%	30.80	28.71	- 7.3%
Total Adult Aluminum Sticks	NIL	NIL	No change	NIL	NIL	No change	N/A	N/A	N/A
Total Junior Aluminum Sticks	NIL	NIL	No change	NIL	NIL	No change	N/A	N/A	N/A
Total Adult Aluminum Shafts	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Junior Aluminum Shafts	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**1,927.801**	**2,195.778**	**- 12.2%**	**$ 64.822.801**	**$ 53.198.508**	**+ 21.9%**	**$ 33.63**	**$ 24.23**	**+ 38.8%**

Replacement Blade Sales



Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Composite Blades

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$15 and over	231,873			$ 6,432,486			$ 27.74	
Under $15	27,769			355,138			12.79	
TOTAL	259,642			$ 6,787,624			$ 26.14	

Senior Blades (fiberglass-reinforced hosel)

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$11 and over	148,875			$ 2,046,537			$ 13.75	
Under $11	91,022			725,979			7.98	
TOTAL	239,897			$ 2,772,516			$ 11.56	

Senior Blades (hosel not fiberglass-reinforced)

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$8 and over	101,374			$ 1,012,403			$ [illegible]	
Under $8	50,647			260,370			5.14	
TOTAL	152,021			$ 1,272,773			$ 8.37	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Junior Blades (with and without reinforced hosels)

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$7 and over	106,335			$ 949,478			$ 8.93	
Under $7	13,262			65,631			4.95	
TOTAL	119,597			$ 1,015,109			$ 8.49	

PVC Blades

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
All prices	NIL			$ NIL			$ N/A	

Total All Replacement Blades

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	771,157			$ 11,848,022			$ 15.36	

2003 Sales Compared to 2002 Sales

Composite Blades

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
All prices (*)	259,642	158,705	+ 63.6%	$ 6,787,624	$ 4,235,987	- 60.3%	$ 26.14	$ 26.69	2.1%

(*) Price lines were consolidated (from the original questionnaire) in 2002 to protect individual-company data

Senior Blades (fiberglass-reinforced hosel)

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
$11 and over	148,875	257,088	- 42.1%	$ 2,046,537	$ 3,430,301	- 40.3%	$ 13.75	$ 13.34	- 3.1%
Under $11	91,022	64,118	+ 42.0%	725,979	517,013	+ 40.4%	7.98	8.06	1.0%
TOTAL	**239,897**	**321,206**	**- 25.3%**	**$ 2,772,516**	**$ 3,947,314**	**- 29.8%**	**$ 11.56**	**$ 12.29**	**- 5.9%**

Senior Blades (hosel not fiberglass-reinforced)

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
$8 and over	101,374	185,081	- 45.2%	$ 1,012,403	$ 1,911,429	- 47.0%	$ 9.99	$ 10.33	- 3.3%
Under $8	50,647	62,946	- 19.5%	260,370	452,474	- 42.5%	5.14	7.19	28.5%
TOTAL	**152,021**	**248,027**	**- 38.7%**	**$ 1,272,773**	**$ 2,363,903**	**- 46.2%**	**$ 8.37**	**$ 9.53**	**- 12.2%**

2003 Sales Compared to 2002 Sales

Junior Blades (with and without reinforced hosels)

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$7 and over	106,335	183,860	- 42.2%	$ 949,478	$ 1,714,965	- 44.6%	$ 8.93	$ 9.33	4.3%
Under $7	13,262	20,855	- 36.4%	65,631	112,124	41.5%	4.95	5.39	8.0%
TOTAL	119,597	204,715	- 41.6%	$ 1,015,109	$ 1,827,089	- 44.4%	$ 8.49	$ 8.93	- 4.9%

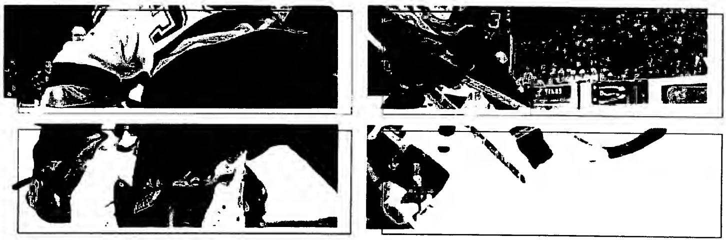
PVC Blades

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
All prices	NIL	NIL	No change	$ NIL	$ NIL	No change	$ N/A	$ N/A	N/A

Total All Replacement Blades

	Unit Sales			Dollar Sales			Average Cost		
	2003	2002	Change	2003	2002	Change	2003	2002	Change
TOTAL	771,157	932,653	- 17.3%	$ 11,848,022	$ 12,373,893	- 4.2%	$ 15.36	$ 13.27	+ 15.7%

Goalie Stick Sales



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Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

Foam Core Goalie Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$35 and over	37,879			$ 1,461,051			$ 38.57	
Under $35	52,934			1,350,511			25.51	
TOTAL	**90,813**			**$ 2,811,562**			**$ 30.96**	

All Other Senior Goalie Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$25 and over	18,078			$ 594,055			$ 32.86	
$20 to $24.99	5,898			139,610			23.67	
Under $20	2,550			42,360			16.61	
TOTAL	**26,526**			**$ 776,025**			**$ 29.26**	

All Other Intermediate Goalie Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$20 and over	3,930			$ 117,762			$ 29.96	
Under $20	102			1,968			19.27	
TOTAL	**4,032**			**$ 119,720**			**$ 29.09**	

Total Sales Shipped January 1, 2003 Through December 31, 2003
(reported in U.S. dollars)

All Other Junior Goalie Sticks

Net Dealer Cost	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
$16 and over	9,523	______	______	$ 202,383	______	______	$ 21.25	______
$14 to $15.99	1,430	______	______	21,758	______	______	15.22	______
Under $14	1,133	______	______	14,170	______	______	12.51	______
TOTAL	12,086	______	______	$ 238,311	______	______	$ 19.72	______

Total All Goalie Sticks

	Sales (Units)	Our Sales (In Units)	Our Market Share (In Units)	Sales (Dollars)	Our Sales (In Dollars)	Our Market Share (In Dollars)	Industry-Wide Average Cost	Our Average Cost
TOTAL	133,457	______	______	$ 3,945,626	______	______	$ 29.56	

2003 Sales Compared to 2002 Sales

Foam Core Goalie Sticks

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
All prices (*)	90,813	78,944	+ 15.0%	$ 2,811,562	$ 2,566,473	+ 9.5%	$ 30.96	$ 32.51	4.8%

(*) Price lines were consolidated (from the original questionnaire) in 2002 to protect individual-company data.

All Other Senior Goalie Sticks

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
$25 and over	19,078	21,567	16.1%	$ 594,055	$ 760,884	21.8%	$ 32.96	$ 35.26	6.8%
$20 to $24.99	5,808	9,842	40.1%	139,610	231,038	39.8%	23.67	23.57	- 3.4%
Under $20	2,550	4,840	47.3%	42,360	80,503	47.4%	16.61	16.65	0.2%
TOTAL	**26,526**	**36,239**	**- 26.8%**	**$ 776,025**	**$ 1,072,415**	**- 27.6%**	**$ 29.26**	**$ 29.59**	**- 1.1%**

All Other Intermediate Goalie Sticks

	Unit Sales			Dollar Sales			Average Cost		
Net Dealer Cost	2003	2002	Change	2003	2002	Change	2003	2002	Change
All prices (*)	4,032	1,935	+ 108.4%	$ 119,728	$ 39,615	+ 202.2%	$ 29.69	$ 20.47	+ 45.0%

(*) Price lines were consolidated (from the original questionnaire) in 2002 to protect individual-company data

2003 Sales Compared to 2002 Sales

All Other Junior Goalie Sticks

Net Dealer Cost	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
$16 and over	9,523	13,737	30.7%	$ 202,383	$ 252,446	19.8%	$ 21.25	$ 18.38	+ 15.6%
Under $16 (*)	2,563	4,729	45.8%	35,928	67,359	46.7%	14.02	14.24	1.5%
TOTAL	12,086	18,466	- 34.5%	$ 238,311	$ 319,805	- 25.5%	$ 19.72	$ 17.32	+ 13.9%

(*) Price lines were consolidated (from the original questionnaire) in 2002 to protect individual company data.

Total All Goalie Sticks

	Unit Sales 2003	Unit Sales 2002	Unit Sales Change	Dollar Sales 2003	Dollar Sales 2002	Dollar Sales Change	Average Cost 2003	Average Cost 2002	Average Cost Change
TOTAL	133,457	135,584	- 1.6%	$ 3,945,626	$ 3,998,300	- 1.3%	$ 29.56	$ 29.49	+ 0.2%

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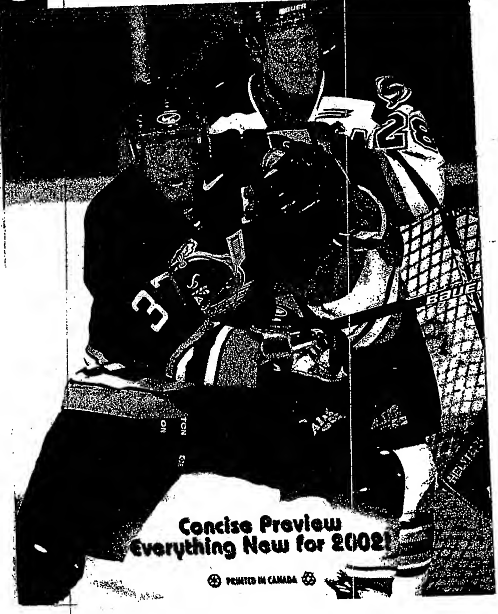
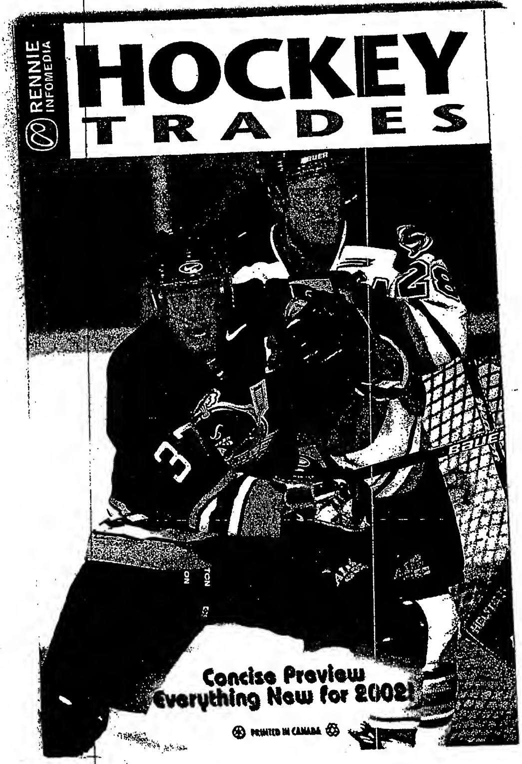
HOCKEY TRADES




RENNIE INFOMEDIA
HOCKEY
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Everything New for 2002!
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Easton adds new sticks and composite replacement blades

Easton has added new sticks to both its Z-Bubble and Hybrid lines along with new composite blades. Highlighting the new two-piece Z-Bubble program is the Z-Bubble Grip featuring Easton's post-process application "that offers a different shaft texture for the player who prefers a more tackified feel and surface," said Easton. "The Z-Bubble Grip also boasts a new Metal Matrix wrap that provides weight reduction while maintaining strength characteristics of the Generation 1 Z-Bubble." The Z-Bubble will be available in three senior flexes (110, 100 and 85). A new intermediate model has also been added to the Z-Bubble line with reduced shaft geometry in a 75 flex.

Easton's Hybrid line, which combines graphite-constructed blades with the feel of a wood shaft, has expanded with three new sticks – each available in two patterns (Yzerman and Modano). First, is the Z-Carbon 70 featuring intermediate shaft geometry. Next, is the new elite-level junior Z-Carbon 65 stick made with a carbon-reinforced glass laminate construction. Rounding out the new Hybrid sticks offerings is the Z-Carbon 50 model, a junior model similar to the Z-Carbon 65 but without the reinforcement. "As such, it flexes somewhat softer and addresses the needs of a larger segment of the junior category," said Easton.

There is a new look to all composite replacement blades at Easton for 2002. "The most exciting addition to the line if the Junior Z-Carbon model," Easton said. "This product represents the highest level of technology and performance available to junior players in the replacement blade category. The blade weighs a mere 135 grams and offers all the stiffness and feel of its senior counterpart." More information: Easton Sports, 7855 Haskell Ave., Suite 200, Van Nuys, CA 91406-1902. 818/781-1587. Fax: 818/782-6012. **Canadian retailers contact:** Easton Sports Canada, 2000 Place Transcanadienne, Dorval, Qc H9P 2X5. 514/685-0550. Fax: 514/685-9797.

Easton expands Synergy into stand-alone category for 2002

Easton has expanded the Synergy line from 10 SKU's in 2001 to 64 SKU's for 2002 with new sticks, flexes and patterns. "We feel this expansion of the Synergy technology to full category status offers a product for all elite-level athletes, regardless of age, size, strength or pattern preference," said Easton. The new senior Grip Synergy stick in the senior line features a textured surface on the shaft for improved grip and will be available in two flexes (100 and 110) and six patterns (Yzerman, Sakic, Modano, Shanahan, Lindstram and Drury). Easton has also added a new senior Synergy stick, with a softer 85 flex, offering yet another option to the Synergy line. It is available in the same patterns as the Grip Synergy.

Easton Synergy sticks will also be offered in intermediate and junior models for 2002. The Intermediate Synergy utilizes reduced shaft geometry but with a senior size blade. It has a 75 flex and is available in two patterns (Drury and Modano). The junior Synergy is offered in a 50 flex with Yzerman and Modano patterns. More Information: Easton Sports, 7855 Haskell Ave., Suite 200, Van Nuys, CA 91406-1902. 818/781-1587. Fax: 818/782-6012. **Canadian retailers contact:** Easton Sports Canada, 2000 Place Transcanadienne, Dorval, Qc H9P 2X5. 514/685-0550. Fax: 514/685-9797.

RENNIE INFOMEDIA

HOCKEY TRADES

The hot trends & innovative new hockey gear for 2001/2002

Detailed Preview Inside

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Chri— introduce DiamondLite shaft, expand SB series

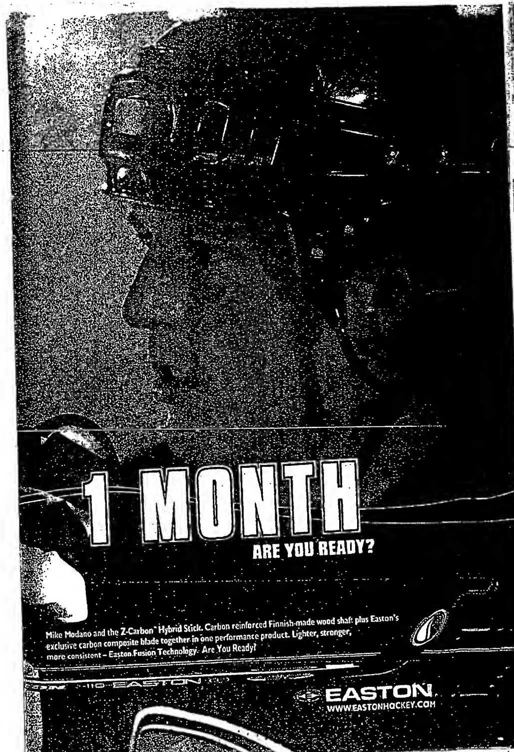
Chris— cing a new DiamondLite Kevlar/carbon composite hockey shaft — a partnership with leading golf shaft manufacturer True Tem — p, three gold medal-winning hockey players from Christian wor— the Performance Tube Testing division at True Temper to use gol— development of a composite handle, designed to meet the spe— ity," Christian Brothers said. This shaft, which will have distinc— 295 grams – in a 48-in. length. The DiamondLite also features— forcements in the slash zone to improve its durability. "It is ex— d strong," said Christian Brothers. "With the feel of wood, it — ntrol." The DiamondLite will be available in four different fle— to be matched to the right handle for increased shot speed an— termediate size DiamondLite handle will also be introduced to — younger, smaller players and women. This intermediate handl—

C— to add two new sticks to its all-wood SB series, created for bi— the developed players. With these additions, the SB series n— beginners to professionals (initially, the series had been for p— year old). "Designed to focus on what have always been — considerations in selecting a hockey stick – flex and lie, the — result of requests from more advanced players to have SB — in," said Christian Brothers. To help match the player to the — ian Brothers has developed a height-to-weight ratio chart. — s which of the different size, length and flex handles in the SB s— optimum results any individual player. Lie numbers, which — ill also be indicated on all sticks in the SB series. More information— nc., P.O. Box C, Warroad, MN 56763. 218/386-1111. FAX— free: 800/346-5055.

Eas— stick category with its unique new hybrid line

East— the new category of hybrid sticks with the introduction of its new — rid 110, 100 and 95 sticks. "With the Hybrid, we fused a woo— fiber composite blade together, making the first stick of its kind— Hybrid stick takes carbon paddle construction and the best shaf— make an exceptionally light, thin, stiff, well-balanced, precision— tter feel, better performance and better results."

The — line features an aspen wood shaft from Finland, with a three-piec— Carbon Hybrid 110 shaft will also have eight strips of carbon — Z-Carbon Hybrid 100 will have 4 strips of carbon reinforc— ility. The entire Z-Carbon line will feature a unique carbon blac— logy, with an expanded foam core system designed to provide— light feel. The blade utilizes aerospace carbon graphite, whi— ze and keeps the blade true to the target line," said Easton. An— ular sock increases the degree of contact between the blade and— additional level of wear resistance on high impact surfaces. Eas— de venting to the bottom of the shaft to give these sticks imp— t



HOCKEY STICKS

Easton has also created a new category of Hybrid replacement blades featuring Fusion technology. "The Hybrid blades play and feel just like their wood counterparts, but the consistency and weight are unmatched by any blade," said Easton. More information: Easton Sports, 7855 Haskell Ave., Suite 200, Van Nuys, CA 91406-1902. 818/781-1587. FAX: 818/782-6012. **Canadian retailers contact:** Easton Sports/ Canada, 2000 Place Transcanadienne, Dorval, Qc H9P 2X5. 514/685-0550. FAX: 514/685-9797.

Exel introduces Finnish replacement blade technology

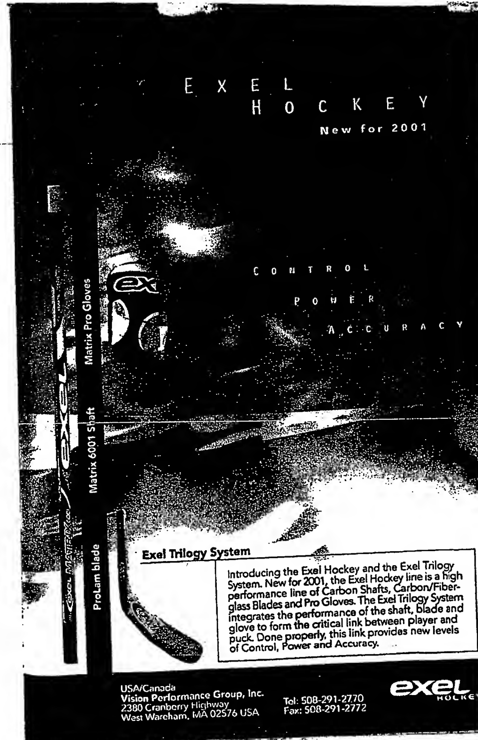
Exel will introduce a complete line of high-performance, Finnish-made replacement blades in carbon and fiberglass wood combinations (to complement its new Carbon shaft line for 2001). Exel will offer two blades, the ProLam and ProLam ABS in senior and junior models. The ProLam blades feature a unique Finnish seven-layer wood and fiberglass laminate construction with a complete fiberglass wrap, birch ply tenon and the choice of a 4-Carbon or 6-Carbon laminate running vertically down the hosel. "These blades feature two layers of fiberglass fabric between the birch wood veneers, on each side of the blade. This attention to detail provides a blade with increased stiffness and durability," said Bob Hunnewell, president of Vision Performance Group, and the exclusive North American distributor of Exel hockey products. The senior ProLam is available in six patterns and the junior ProLam, with similar fiberglass and wood laminate construction, will be available in two patterns.

The ProLam ABS senior blade has the same 4-Carbon construction but features a top to bottom ABS insert for increased durability and wear. It is available in four blade patterns. The junior ProLam ABS is constructed using two maple veneers with two fiberglass laminates on each side of the blade for increased stiffness and is available in one pattern. More information: Vision Performance Group Inc., 2380 Cranberry Highway, West Wareham, MA 02576. 508/291-2770. FAX: 508/291-2772. E-mail: info@vispg.com

Exel unveils two new lines of carbon shafts for North America

Exel is introducing two new carbon shaft lines to the North American market, distributed exclusively by Vision Performance Group, featuring Triaxial Braided Technology and Co-Wound Technology. Exel will have "a full range of senior and junior carbon hockey shafts to meet player performance requirements at all levels," said Bob Hunnewell, president of Vision Performance Group.

The Matrix 5001 and 6001 senior shafts are both manufactured using a Triaxial Braided Technology (TBT) construction. This technology "produces a shaft with exceptional torsional stiffness and outstanding reflex response at the desired stiffness rating for each player," said Bob Hunnewell. "And the new Exel manufacturing process increases durability substantially over existing shafts." The Matrix 5001 is designed for the finesse player and features an exclusive +/- 45 degree outer braid (for high torsion stiffness), reduced radius shaft design and a new Exel grip designed for playability, feel and control. It is available in 85-mid stiff, 100-stiff, and 110-Xstiff. The Matrix 6001 incorporates many of the same features as the 5001, but includes an ABS slash strip to increase durability and is available in 100-stiff, 110-Xstiff and 120-XXstiff.



US005303916A

United States Patent [19]

Rodgers

[11] **Patent Number: 5,303,916**

[45] **Date of Patent: Apr. 19, 1994**

[54] **HOCKEY STICK SHAFT**

[75] Inventor: **Aubrey Rodgers**, Surrey, Canada

[73] Assignee: **Loraney Sports, Inc.**, New York, N.Y.

[21] Appl. No.: **954,156**

[22] Filed: **Sep. 30, 1992**

[51] **Int. Cl.**[5] **A63B 59/12**

[52] **U.S. Cl.** .... **273/67 A**

[58] **Field of Search** .... 273/67 A, 73 J, 72 R, 273/72 A, 80 R

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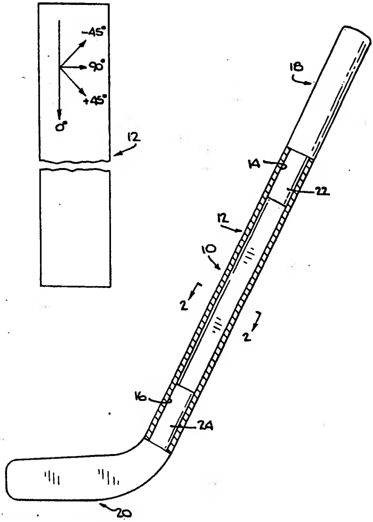
Primary Examiner—Mark S. Graham
Attorney, Agent, or Firm—Rodman & Rodman

[57] **ABSTRACT**

The improved hockey stick shaft is of elongated tubular configuration, rectangular in cross section, and having opposite open ends. The tubular shaft is formed by pultrusion of a plurality of discrete layers of bondable material including at least one layer of random strand mat glass fibers, at least two layers of $0^\circ/90^\circ$ balanced plain weave glass fiber fabric, at least two layers of $\pm 45^\circ$ balanced stitched layered glass fiber fabric, at least one layer of 0° unidirectional carbon fiber roving, and at least one layer of 0° unidirectional glass fiber roving. The layers can be bonded together by a suitable resin, preferably an epoxy resin.

18 Claims, 1 Drawing Sheet



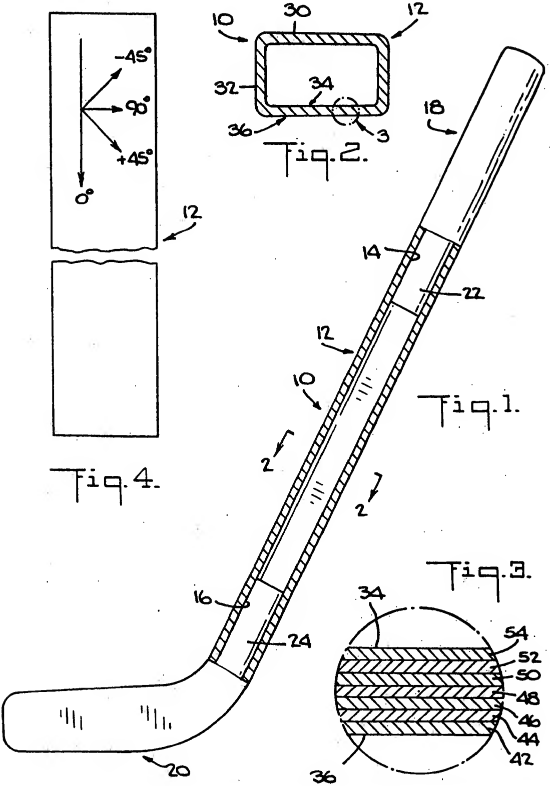


Fig. 4.

Fig. 2.

Fig. 1.

Fig. 3.

HOCKEY STICK SHAFT

BACKGROUND OF THE INVENTION

This invention relates to hockey sticks and more particularly to an improved hockey stick shaft for replaceable hockey blades and handles.

The expanding popularity of hockey at the amateur and professional levels has been fueled by increasing spectator interest in the sport. As a result, there has been a growing demand for hockey equipment, especially hockey sticks.

Hockey sticks have traditionally been a one-piece wooden structure. During a typical hockey game, a hockey stick can impact the ice hundreds of times at force levels that often result in fracture or breakage of the stick. Breakage of a hockey stick occurs most frequently at the blade portion or at the lower part of the shaft that extends from the blade portion. It is thus fairly common for many hockey players to replace a broken stick at least once during each hockey game.

In an attempt to improve the durability of a hockey stick without sacrificing the characteristics of weight, feel, and flexibility that are desirable in a hockey stick, materials other than wood have been resorted to in constructing hockey sticks. Thus, although a wooden hockey stick has set the standard for weight, feel and propulsion of a puck, a new generation of sticks have been formed of plastic and aluminum, as well as laminates of fibrous, plastic and resinous materials. Generally, plastic and aluminum provide good strength characteristics for a hockey stick, but the weight, wear and feel of these materials do not command universal acceptance by hockey players.

Since most hockey players prefer a wooden hockey blade, much attention has been directed to the development of a durable, non-wooden hockey stick shaft that can be used with a wooden blade but is less likely to break than a wooden shaft. One result of such development effort is a hollow aluminum or fibrous hockey stick shaft capable of receiving a replaceable blade that can be formed of wood or plastic.

For example, U.S. Pat. No. 4,086,115 to Sweet, et al. shows a hollow hockey stick shaft made from graphite fiber and resin. The hockey stick includes a wooden blade with a tongue that engages one end of the hollow shaft and is bonded therein with a polyester resin mixture. It has been found that hollow shafts formed of graphite fiber and resin as disclosed in this patent, are more durable than wooden shafts but are still prone to fracture under the usual forces that a stick is subject to in a hockey game.

Thus the problem of shaft breakage or fracture in a hockey stick that includes a hollow shaft, such as disclosed in U.S. Pat. Nos. 4,591,155; 4,600,192; 5,050,878; 4,553,753; 4,361,325; 3,961,790; 4,358,113; 3,934,875 and 4,968,032 ,has been alleviated but not solved since breakage and fracture are still common occurrences even in aluminum or fibrous material hockey stick shafts.

It is thus desirable to provide a hockey stick shaft that is relatively indestructible during a hockey game, permits replaceable use of blades and an end handle, and retains the flexibility and feel commonly associated with a wooden stick.

OBJECTS AND SUMMARY OF THE INVENTION

Among the several objects of the invention may be noted the provision of a novel hockey stick shaft, a novel hockey stick shaft having a greater resistance to breakage and distortion than aluminum or wood shafts, a novel hockey stick shaft which, if broken, does not splinter or produce shards, a novel hockey stick shaft which has the feel of wood, is shock absorbing and flexes but does not bend permanently, and a novel method of improving the torsional strength and fatigue strength of a tubular hockey stick shaft.

Other objects and features of the invention will be in part apparent and in part pointed out hereinafter.

In accordance with the invention, the hockey stick shaft is an elongated tubular member formed as a plurality of discrete layers of bondable material, preferably bonded together by epoxy resin.

In a preferred embodiment of the invention, the hockey stick shaft has a layer sequence from the outside surface to the inside surface of the shaft of,

a) a layer of random strand mat glass fibers,
b) a layer of 0°/90° balanced plain weave glass fiber fabric,
c) a layer of 0° unidirectional glass fiber roving,
d) two layers of ±45° balanced stitched layered unidirectional glass fiber fabric,
e) a layer of 0° unidirectional carbon fiber roving, and
f) a layer of 0°/90° balanced plain weave glass fiber fabric.

The hockey stick shaft is preferably formed by pultrusion and is of substantially uniform wall thickness with opposite open ends adapted to receive a replaceable handle and a replaceable hockey blade.

Under this arrangement, the hockey stick shaft is endowed with torque and twisting strength characteristics that provide good resistance against breakage and distortion, and if broken, the shaft does not produce splinters or shards. The hockey stick shaft is thus nonhazardous in the event of breakage.

The invention accordingly comprises the constructions and method hereinafter described, the scope of the invention being indicated in the claims.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. 1 is a simplified schematic elevation of a hockey stick, partly shown in section, incorporating the shaft of the present invention;

FIG. 2 is a simplified sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary detail of section 3 of FIG. 2, showing the laminate structure of the hockey stick shaft;

FIG. 4 is a simplified schematic of the hockey stick shaft showing the angular direction of the layup materials that constitute the hockey stick shaft.

Corresponding reference characters indicicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

A hockey stick incorporating the present invention is generally indicated by the reference number **10** in FIG. 1.

The hockey stick 10 includes an elongated tubular shaft member 12 of generally rectangular cross section that is approximately 48 inches long with openings 14 and 16 at opposite ends. The shaft 12, in cross section, has a side 30 approximately 1.2 inches wide and a side 32 approximately 0.8 inches wide. The wall thickness of the shaft 12 is substantially uniform and can vary from about 0.070 to 0.1 inches, preferably about 0.075 to 0.095 inches, and most preferably about 0.080 to 0.085 inches.

A replaceable handle 18 includes a reduced neck portion 22 adapted to fit into the opening 14 of the shaft 12, and a replaceable hockey blade 20 includes a similar reduced neck portion 24 adapted to fit in the opening 16. Preferably, the handle 18 and the blade 20 are made of wood.

The reduced neck portions 22 and 24 of the handle 18 and the blade 20 are coated with a conventional hot melt adhesive, which liquifies when heated and solidifies when cooled and can easily be activated from a convenient source such as a conventional portable hand-held hair dryer. The heat is applied to the shaft 12 at the are of the engaged neck portions 22 and 24, and melts the adhesive to activate the bonding action between the adhesive, the neck portions 22 and 24 and the inside surface 34 of the shaft 12.

Referring to FIG. 3, the shaft 12 includes a layup of discrete layers 42, 44, 46, 48, 50, 52 and 54, which can include unidirectional glass fiber and carbon fiber roving, continuous strand random fiber mat and/or balanced plain weave fiber fabric, and/or stitched layered fabric.

The layup sequence is the stacking sequence of the various fiber orientations in an angular direction that is parallel to the longitudinal axis of the hockey stick shaft. In a pultrusion process, the fiber orientation would be axisymmetric. The layers 42-54, in the layup sequence of FIG. 3 from the outside surface 36 of the shaft 12 to the inside surface 34 are preferably constituted as follows:

1) Layer 42 consists of a single wrapping of a continuous strand glass fiber mat having a random pattern, and whose weight can vary from about 0.5 to 2 ounces per square foot. A suitable continuous strand glass fiber mat is sold under the designation "8641" by Owens Corning Fiberglass Co. The thickness of this layer can vary from about 0.006 to about 0.010 inches, and is preferably about 0.008 inches.
2) Layer 44 consists of a single wrapping of balanced 0°/90° plain weave glass fiber fabric, such as that sold by Mutual Industries, Philadelphia, Pennsylvania under the brand name "Style 2964."The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
3) Layer 46 consists of 0° unidirectional glass fiber roving, known as "continuous roving", such as that sold by Owens Corning Fiberglass Co., Toledo, Ohio. The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
4) Layers 48 and 50 are identical and consist of a single wrapping of balanced ±45° stitched layered glass fiber fabric, such as that sold under the brand name Knytex™ by Hexcel Co., Minneapolis, Minnesota. The thickness of each layer 50 and 48 can vary from about 0.013 to about 0.017 inches, and is preferably about 0.015 inches;
5) Layer 52 consists of 0° unidirectional carbon fiber roving, such as that sold under the brand name Grafil™ Grade 34-700 by Mitsubishi Grafil Co., Sacramento, California. The thickness of this layer can vary from about 0.010 to about 0.014 inches, and is preferably about 0.012 inches;
6) Layer 54 is identical to layer 44 and consists of a single wrapping of balanced 0°/90° plain weave glass fiber fabric. The thickness of this layer can vary from about 0.010 to 0.014 inches, and is preferably about 0.012 inches.

Layers 44 and 54 can also each comprise a single wrapping of a balanced 0°/90° stitched layered glass fiber fabric, such as that sold under the brand name Knytex™ by Hexcel Co.

A thin outside surfacing veil (not shown) made of a thermoplastic polyester, such as Nexus™ manufactured by Precision Fabrics Group, Greensboro, North Carolina, is used to provide the outer surface of the shaft with a smooth uniform surface. The surfacing veil is about 0.002 to 0.003 inches thick.

The wall thickness of the hockey stick shaft can vary from about 0.07 to 0.1 inches, preferably about 0.075 to 0.095 inches and most preferably about 0.080 to 0.085 inches. The shaft 12 is preferably made using the technique of pultrusion.

The non-0° materials are fed from rolls of about 3.5 to 4.25 inches wide. The 0° unidirectional carbon fiber rovings can contain about 6000-48000 filaments per roving, and preferably about 24,000 filaments per roving, which are evenly distributed around the entire cross-section of the shaft. The 0° unidirectional glass fiber roving can vary from about 64 yards per pound yield to about 417 yards per pound yield, and most preferably about 247 yards per pound yield.

In the pultrusion production line, the innermost two layers, that is, the 0°/90° glass fiber fabric and the 0° unidirectional carbon fiber roving are fed into a preforming section and impregnated at a first impregnating zone with an epoxy resin, such as Glastic Grade 5227789 , Glastic Corporation, Glastic, Ohio, or Shell Epon™ 828 , Shell Chemical Company.

The resins of choice for impregnating and bonding the layup materials are epoxy resins, which have very low shrinkage during polymerization or curing and also have high strength to failure. Thus, epoxy resins are ideally suited for the preparation of the composite carbon fiber hockey stick shaft.

As the innermost two layers proceed along the production line, the two layers of ±45° glass fiber fabric and the 0° glass fiber roving are added and impregnated with the epoxy resin at a second impregnating zone.

The final 0°/90° glass fiber fabric, the 8641 continuous strand glass fiber mat and the surfacing veil are then added to the production line and fed into a final impregnating zone that surrounds the entire layup production line. The final outside layers are then impregnated with the epoxy resin. On a weight basis, the epoxy resin comprises about 20% to 40%, and preferably about 30 weight % of the hockey stick shaft.

The layup production line is then continuously pulled through a shaped orifice in a heated steel die to give the layup the geometry of the rectangular hockey stick shaft, as seen in FIG. 2. As the materials pass through the die, the epoxy resin and a suitable curing agent, such as methylene diamine or a mixed amine curing agent well known in the art, cures continuously to form a

rigid cured profile corresponding to the hollow rectangular longitudinal shape of the hockey stick shaft.

The layup sequence in the production line is typically pulled through a die that can preferably vary from about 2 to 3 feet in length. The processing temperatures can vary from about 300° to 400° F., preferably about 300° to 320° F., and most preferably about 310° F. along the first half of the die, and preferably about 340° to 360° F., and most preferably about 350° F. along the second half of the die. Typical production line speed can vary from about 6 to 14 inches per minute and preferably about 10 inches per minute.

When the hockey stick 10 is used to hit a puck (not shown), the shaft 12 in reaction has a tendency to twist or be in torsion. The ±45° orientation of the two layers 46 and 48 of ±45° balanced stitched layered glass fiber fabric is believed to provide improved torque and twisting strength to the shaft 12. The additional torque and twisting strength of the shaft 12 provides improved resistance against breakage and distortion.

Another important aspect of the invention is that the 0° unidirectional carbon fiber roving should not be located in the central portion of the layup sequence. It has been found that improved physical properties occur when the 0° carbon fiber roving is located away from the central layer, and is preferably located adjacent to the inside surface or the outside surface of the hockey stick shaft.

The improvement in properties appears due to the fact that when the 0° carbon fiber roving is located in the central portion of the layup sequence, it does not significantly contribute to the overall physical properties of the hockey stick shaft. However, when it is located closer to the outer surface of the layup sequence, improved physical properties occur, particularly in terms of the flexural strength.

Thus, the closer the layer of 0° carbon fiber roving is to the inner or outer surface of the shaft, the more significant will be its contribution to enhanced physical properties, apparently because there is not a uniform stress state in the material. In the central portion there is almost no stress at all because the size of the carbon fiber is not significantly changing when there is bending. Thus, on one side (the outer side), the carbon fiber will stretch, and on the other side (the inner side) the carbon fiber will compress and there is a gradient across from the center line of the roving to the surface.

The closer the carbon fiber roving is to the surface, the greater effect it has in contributing to improved physical properties. The closer it is to the center, the less it will contribute.

Although pultrusion is the preferred method of producing the improved carbon fiber hockey stick shaft, other methods can also be used, such as matched die molding or hand lamination of the multiple layers. The typical improved carbon fiber hockey stick shaft of the present invention has a length of about four feet. However, length can vary in accordance with individual preference. In addition, the layup sequence of materials can also vary.

The following examples are illustrative of the present invention:

EXAMPLE 1

In this example, A, B, C, D and E are each 8 inch wide by 12 inch long flat laminates of separate layup sequences. The materials in each layup sequence are tabulated in Table 1. The physical properties for each layup laminate are tabulated in Table 2. Each line item in the layup sequence is a single discrete layer of material. Each of the 0°/90° FG, 0°FG, 0° CF layers were 0.012 inches thick. The 8641 layer was 0.008 inches thick and the ±45° FG layer was 0.015 inches thick.

The layup was formed by placing one half of the layers (the first four layers in the 8 layer laminates of A, D and E and the first five layers in the 9 layer laminates of B and C) in a mold preheated to 300° F. 135 grams of Glastic 5227789 epoxy resin were poured into the center of the uppermost layer in the mold. The remaining plies were laid on top and 1400 psi pressure from an hydraulic press was then applied for five minutes.

TABLE 1

A	B	C	D	E
8641	8641	8641	8641	8641
0°/90° FG	0° CF	0°/90° FG	0° CF	0° CF
0° FG	±45° FG	±45° FG	±45° FG	45° FG
±45° FG	0°/90° FG	0° FG	0°/90° FG	0°/90° FG
±45° FG	0° FG	0° CF	0°/90° FG	0°/90° FG
0° CF	0°/90° FG	0° FG	±45° FG	±45° FG
0°/90° FG	±45° FG	±45° FG	0° CF	0° FG
8641	0° CF	0°/90° FG	8641	8641
	8641	8641		

TABLE 2

Layup Sequence	A	B	C	D	E
Tensile Strength (psi)	84,060	101,000	64,740	100,200	44,430
Tensile Modulus (psi × 10^{-6})	9.76	11.5	6.9	10.3	2.65
Flex Strength (psi)	66,410	78,890	54,260	78,060	71,890
Flex Modulus (psi × 10^{-6})	3.89	10.21	3.16	9.68	2.66
Notched Izod (ft.-lb./in.)	33.8	38.9	33.1	30.8	43.6

As seen from Table 1 and Table 2, the various configurations in the layup sequence can be changed to achieve the balance of properties desired by the user to achieve desired flexibility, stiffness (flex modulus) and strength (tensile strength).

It was observed that carbon fibers closer to the surface gave better physical properties. The highest impact strength (notched Izod) resulted with an all-glass fiber layup (E). There was a higher modulus with carbon than with glass fiber.

EXAMPLE 2

A fifteen year old Canadian hockey player used a number of different hockey sticks over a two-day period, including two prototypes of the inventive hockey stick shaft. The sticks were used to hit a standard National Hockey League hockey puck several times over a smooth ice surface on a day when the temperature was about 55°. The average speed of the puck was measured by a Sports-Star SL-300 hand held radar gun manufactured by Sports-Star Co. of Portland Oregon. There were appropriate rest intervals and stick rotation.

The average speed was calculated on the basis of 10 shots per day with each hockey stick, eliminating the highest and lowest speeds. The test results are tabulated in Table 3.

TABLE 3

HOCKEY STICK MODEL	AVERAGE SPEED (M.P.H.)	
	DAY 1	DAY 2
1. EASTON STIFF FLEX[a] HXP 4900 GOLD	67.37	68.25
2. EASTON W/CARBON FIBER[a] HX A/C 7100 EXTRA STIFF	66.38	68.00
3. EASTON GRETZKY[a] EXTRA STIFF HXP 5100	70.38	70.50
4. SHERWOOD PMP 7000[b] AL MACINNIS MODEL	70.50	70.75
5. CAMAXX EXTRA STIFF[c] SCR 2000	72.37	71.87
6. CAMAXX STIFF FLEX[c] SCR 1000	74.25	74.62

[a]Easton Sports, Inc., Burlingame, California
[b]Sherwood Drolet Ltd., Sherbrooke, Canada
[c]Prototype of the invention. The layup sequence is as described in the aforesaid description of FIG. 3, with each layer having the preferred thickness. There were 10% more carbon fiber filaments in the SCR 2000 than the SCR 1000 hockey stick shaft. Additional resin replaced the reduced amount of carbon fiber roving in the SCR 1000 hockey stick shaft.

Some advantages of the inventive carbon fiber hockey stick shaft are as follows:

1) 20% lighter than aluminum;
2) Stronger than aluminum and wood;
3) Flexes well but does not bend permanently;
4) Feels like wood as compared to aluminum;
5) Has a much better gripping surface than aluminum;
6) No vibrations —aluminum has tremendous vibrations and needs styrofoam for stabilization;
7) The blade can be installed and removed with a heat gun rather than a blow torch and is thus safer to use and more convenient;
8) There is efficient removal of the blade or handle;
9) Cost is comparable to aluminum;
10) Has high capacity manufacturing capability without production problems;
11) The stick shoots harder and faster than either wood or aluminum;
12) Color will not chip;
13) There is a minimal fatigue factor in comparison with aluminum. Thus the stick retains accuracy throughout its life;
14) It is more durable and economical because there is minimal fatigue or breakage;
15) It is safer than wood or aluminum and there are no splinters or shards. If the stick breaks, there is a benign fracture;
16) Blades last longer because the shaft absorbs the impact.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes can be made in the above constructions and method without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A hockey stick shaft comprising,

a) an elongated tubular member of generally rectangular cross section having opposite open ends, an inside surface, and an outside surface,

b) said tubular member being formed as a plurality of discrete layers of bondable material in a layup comprising:

(i) at least one layer of random strand mat glass fibers,

(ii) at least two layers of glass fiber material selected from the group consisting of 0°/90° balanced plain weave glass fiber fabric, 0°/90° stitched layered glass fiber fabric, and mixtures thereof;

(iii) at least two layers of ±45° balanced stitched layered glass fiber fabric,

(iv) at least one layer of 0° unidirectional carbon fiber roving,

(v) at least one layer of 0° unidirectional glass fiber roving, wherein said layers are bonded together by a resin.

2. The hockey stick shaft as claimed in claim 1, wherein the resin is an epoxy resin.

3. The hockey stick shaft as claimed in claim 1 having the following sequence of layers in a direction from the outside surface to the inside surface of said shaft,

a) a layer of said random strand mat glass fibers,

b) a layer of said 0°/90° balanced plain weave glass fiber fabric,

c) a layer of said 0° unidirectional glass fiber roving,

d) two layers of said ±45° balanced stitched layered unidirectional glass fiber fabric,

e) a layer of said 0° unidirectional carbon fiber roving,

f) a layer of said 0°/90° balanced plain weave glass fiber fabric,

wherein the layer of said random strand mat glass fiber forms the outside surface of said tubular member and said other layers are the intervening layers in the sequence indicated.

4. The hockey stick shaft as claimed in claim 1, wherein said tubular member is of substantially uniform wall thickness.

5. The hockey stick shaft as claimed in claim 1, wherein one of the opposite open ends is adapted to receive a replaceable handle and the opposite open end is adapted to receive a replaceable hockey blade.

6. The hockey stick shaft as claimed in claim 1, wherein the fiber orientations are measured from an angular direction that is parallel to the longitudinal axis of the hockey stick shaft.

7. The hockey stick shaft as claimed in claim 1, further including an outside surfacing veil of thermoplastic polyester.

8. The hockey stick shaft as claimed in claim 7, wherein the surfacing veil has a thickness range of about 0.002 to 0.003 inches.

9. The hockey stick shaft as claimed in claim 4, wherein the wall thickness of the tubular member is in the range of about 0.07 to 0.1 inches.

10. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of random strand mat glass fibers is in the range of about 0.006 to 0.010 inches.

11. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0°/90° fiber is in the range of about 0.010 to 0.014 inches.

12. The hockey stick shaft as claimed in claim 1, wherein the thickness of each layer of ±45° balanced stitched layered glass fiber fabric is in the range of about 0.013 to 0.017 inches.

13. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0° unidirectional glass fiber roving is in the range of about 0.010 to 0.014 inches.

14. The hockey stick shaft as claimed in claim 1, wherein the layer thickness of 0° unidirectional carbon fiber roving is in the range of about 0.010 to 0.014 inches.

15. In an elongated hollow tubular composite hockey stick shaft formed from a plurality of discrete layers of layup material selected from the group consisting of glass fiber mat, glass fiber roving, carbon fiber roving, woven fabric, stitched layered fabric and mixtures thereof, the improvement which comprises including in the layup sequence

(a) at least one layer of ±45° balanced plain weave glass fiber fabric at a central portion of the layup sequence;

(b) at least one layer of 0° unidirectional carbon fiber roving located away from the central portion of the layup sequence;

(c) at least one layer of 0° unidirectional glass fiber adjacent the layer of ±45° balanced plain weave glass fiber fabric and

(d) at least one layer of 0°/90° glass fiber fabric adjacent the layer of 0° unidirectional carbon fiber roving.

16. A method of improving the torsion strength and fatigue strength of a tubular hockey stick shaft comprising,

(a) forming a layup of:

(i) at least one layer of random strand mat glass fibers,

(ii) at least two layers of glass fiber material selected from the group consisting of 0°/90° balanced plain weave glass fiber fabric, 0°/90° stitched layered glass fiber fabric, and mixture thereof;

(iii) at least two layers of ±45° balanced stitched layered glass fiber fabric,

(iv) at least one layer of 0° unidirectional carbon fiber roving,

(v) at least one layer of 0° unidirectional glass fiber roving, and

(b) bonding said layers of the layup together with a resin at a temperature varying from about 300° to 400° F.

17. The method of claim 16, including using an epoxy resin in the bonding step.

18. The method of claim 16 including of sequencing the layers that form the layup in a direction from the outside surface of the tubular shaft to the inside surface of the tubular shaft in he following order:

a) positioning a layer of said random strand mat glass fibers as the outermost layer of the tubular shaft,

b) positioning a layer of said 0°/90° balanced plain weave glass fiber fabric adjacent the layer of said random strand mat glass fibers,

c) positioning a layer of said 0° unidirectional glass fiber roving adjacent the layer of said balanced plain weave glass fiber fabric,

d) positioning two layer of said ±45° balanced stitched layered unidirectional glass fiber fabric adjacent the layer of said 0° unidirectional glass fiber roving,

e) positioning a layer of said 0° unidirectional carbon fiber roving adjacent said layers of ±45° balanced stitched layered unidirectional glass fiber fabric,

f) positioning a layer of said 0°/90° balanced plain weave glass fiber fabric adjacent said layer of 0° unidirectional carbon fiber roving,

wherein the layer of said random strand mat glass fiber is the outermost layer of said tubular shaft and said other layers are the intervening layers in the sequence indicated.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,303,916

DATED : April 19, 1994

INVENTOR(S) : Aubrey ROGERS

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 2, line 60, change "indicicate" to --indicate--.

In column 3, line 23, change "are" to --area--.

In column 6, Table 1, Column E, second entry, change "CF" to --FG--.

In column 6, Table 1, Column E, third entry, before "45°", insert --±--.

In column 6, line 60, after "55°", insert --F--.

In column 9, line 20, after "fabric", insert --;--.

In column 9, line 33, change "mixture" to --mixtures--.

In column 10, line 10, delete "of" (2nd occurrence).

In column 10, line 13, change "in he" to --in the--.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,303,916

DATED : April 19, 1994

INVENTOR(S) : Aubrey ROGERS

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

In column 10, line 22, change "layer" to --layers--.

Signed and Sealed this

Eleventh Day of October, 1994

Attest:

Bruce Lehman

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

5407195A

United States Patent [19]

Tiitola et al.

[11] Patent Number: 5,407,195

[45] Date of Patent: Apr. 18, 1995

[54] **BLADE CONSTRUCT FOR A HOCKEY STICK OR THE LIKE**

[75] Inventors: Antti-Jussi Tiitola, Kaivanto; Mauri Laitinen, Mikkeli, both of Finland

[73] Assignee: K.C.G. Hockey Finland Oy, Forssa, Finland

[21] Appl. No.: 957,615

[22] Filed: Oct. 6, 1992

[51] Int. Cl.[6] A63B 59/12

[52] U.S. Cl. .... 273/67 A

[58] Field of Search .... 273/67 A, 735, 167 H, 273/67 R; 156/78

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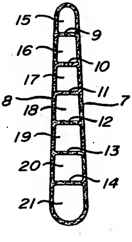
Primary Examiner—Mark S. Graham

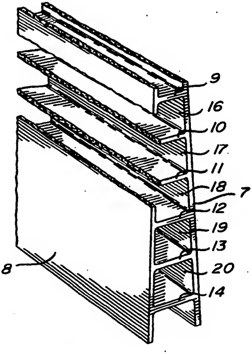
Attorney, Agent, or Firm—Fay, Sharpe, Beall, Fagan, Minnich & McKee

[57] **ABSTRACT**

The present invention relates to a blade construct for a hockey stick or the like. The blade construct has a blade body comprising a first face member, and a second opposed face member. The first and second face members are spaced apart and are of fiber reinforced plastics material. The blade construct is characterized in that, a core cavity member is sandwiched between the first and second face members. The core cavity member comprises one or more bridge members of fiber reinforced plastics material. The first face member, the second face member and the bridge members are integral, and one or more of the bridge members comprises a fiber reinforcing component oriented transversely with respect to the first and second face members.

31 Claims, 4 Drawing Sheets





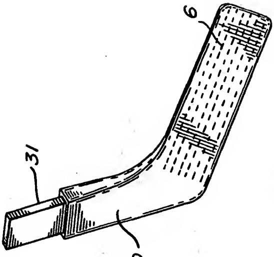


FIG. 12

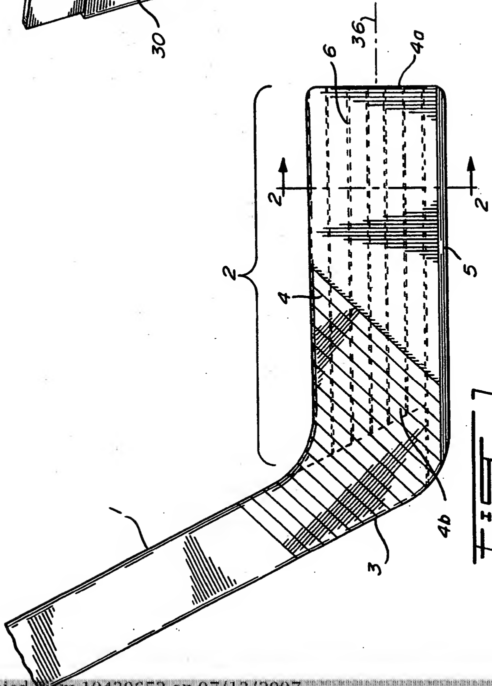


FIG. 1

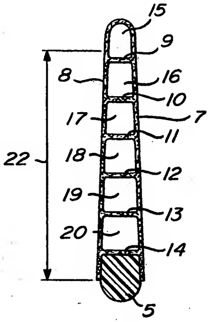


FIG. 2

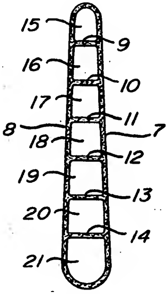


FIG. 3

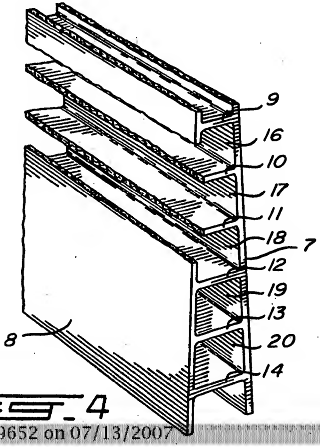


FIG. 4

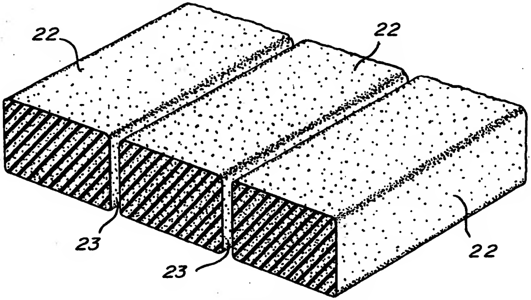


FIG. 5

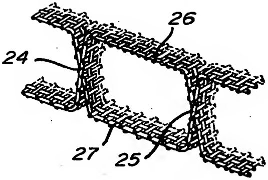


FIG. 6

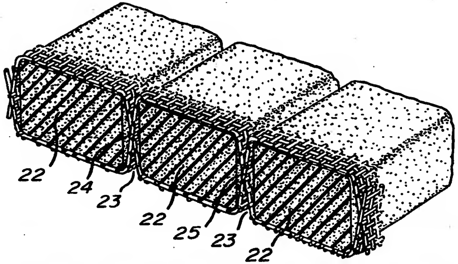


FIG. 7

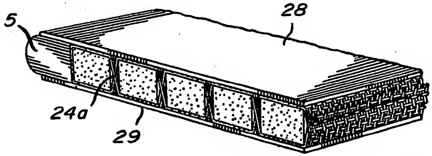


FIG. 8

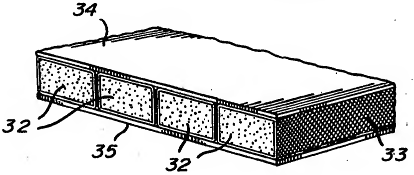


FIG. 9

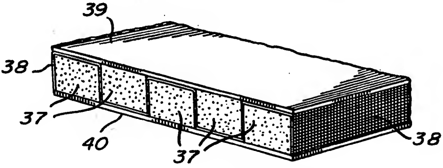


FIG. 10

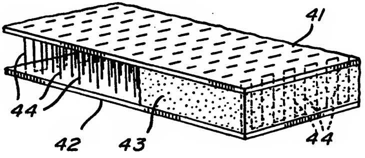


FIG. 11

BLADE CONSTRUCT FOR A HOCKEY STICK OR THE LIKE

FIELD OF THE PRESENT INVENTION

The present invention relates to game stick blades and in particular to a composite blade construction for use with hockey sticks or the like; such sticks include, for example, ice hockey sticks (including goalie sticks), street hockey sticks and the like. The present invention, by way of example only, will be described hereinafter in relation to an ice hockey stick.

DESCRIPTION OF PRIOR ART

Ice hockey sticks generally consist of two basic elements, namely an elongated handle component and a blade secured to the lower end of the handle.

A blade of a hockey stick must be extremely strong in order for it to indure the tremendous forces developed between it and a puck. On the other hand, the blade must have a certain amount of flexibility so that the player has an acceptable level of "feel" while handling a puck or executing a shot. The optimum design of a blade furthermore includes a primary concave contact face which places a further limit on its construction; the blade also usually has a corresponding convex contact face which is more or less parallel to the concave face, i.e. in order to keep the weight of the blade low.

Many types of hockey sticks are presently known.

Traditional blades for ice hockey sticks are made of one or more pieces (e.g. layers) of wood. A shortcoming of wooden blades is that they are generally not strong enough and thus do not hold up well under the usual conditions encountered when playing hockey. Moreover, labour and material costs for the manufacture of wooden blades are relatively high.

A wooden blade may also be reinforced with fiber (e.g. glass) fabric which is impregnated and bonded to the wooden surface with a synthetic resin. These types of reinforced wooden blades have given good results including good playing performance; this performance is mainly the result of the combination of low weight and high stiffness.

Blades made entirely out of synthetic materials are also known; these include composite blades comprising a fiber (e.g. glass) laminated core (see for example U.S. Pat. Nos. 4,059,269, 4,488,721, 4,591,155, 4,600,192, Finnish Pat. No. 65018, etc.). However, difficulties are still encountered in providing a (synthetic) composite blade for a hockey stick that can withstand the substantial impacts to which it is subjected during use and yet provide a "feel" comparable to that of traditional wooden sticks when handling the puck and executing a shot. Plastic blades may, for example, have good strength characteristics but may have (high) weight, (low) wear and/or feel (i.e. low stiffness) characteristics which may be unacceptable to some players. It is possible, for example, to obtain a light weight blade having good stiffness by using a core of polyurethane foam, but, such a core may have a limited shear strength which may lead to internal fracture of the blade during use.

Accordingly, it would be advantageous to have an alternative composite blade construction for a hockey stick or the like which may be strong, durable, lightweight and of acceptable stiffness.

SUMMARY OF THE INVENTION

Generally, in accordance with the present invention, there is provided a blade element of composite construction which has a three dimensional fibre reinforcement structure, i.e. fiber reinforcement is oriented transversely between the (puck contact) face members such that the fiber reinforcement of the face members and those fibers transverse thereto form a three dimensional fiber reinforcement array embedded in a (suitable) resin matrix structure. Thus, the body of a blade element of the present invention may comprises a first face member and second opposed face member, both of fiber reinforced plastics material. These face members may be connected to each other by means of bridge or pillar members also of fiber reinforced plastics material, the bridge members being part of a core cavity member sandwiched between the face members. A transverse fiber component of the reinforcing fiber element of one or more of such bridge members contributes to the strength and stiffness of the construction. A blade element of such configuration may provide a durable structure while at the same time providing a player with the proper "feel" in handling the puck.

Accordingly, in a general aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

a first face member, and
a second opposed face member,
said first and second face members being spaced apart and being of fiber reinforced plastics material,
characterized in that,
a core cavity member is sandwiched between said face members,
said core cavity member comprises one or more bridge members of fiber reinforced plastics material,
said first face member, said second face member and said bridge members are integral, and
one or more of said bridge meters comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with the present invention, the blade construct may, for example, have a plurality of bridge members. Thus, a blade construct may have a plurality of bridge members, one or more of which comprises a fiber reinforcing component oriented transversely with respect to the first and second face members. In accordance with the present invention, a blade construct may, in particular, have a plurality of bridge members, each of which comprises a fiber reinforcing component oriented transversely with respect to the first and second face members.

In accordance with the present invention, the weight (e.g. lightness) of the blade construct may vary as a function of the extent and structure of the core cavity member sandwiched between the opposed face members; i.e. the core cavity member may contribute to the lightness thereof. The core cavity member (apart from the bridge members thereof) may, for example, have a hollow (i.e. empty) aspect; alternatively, it may be filed with some lightweight material (e.g. a plastics foam material or the like) which may or may not, as desired, contribute to the structural integrity of the blade construct and which may or may not be integral with the bridge or face members. The core cavity member may, for example, comprise a pocket or a plurality of pockets

which may be discrete or be interconnected in any desired fashion. The core cavity member may alternately comprise, for example, a plurality of (microspherical) hollows present so as to reduce the specific gravity of the construct. As used herein the expression "core cavity member" is to be understood as including the above aspects.

In accordance with the present invention, the strength of the blade construct will, inter alia, depend on the core cavity bridge members which are integral with the face members (e.g. glued thereto, formed integral thereto, etc.). The number of bridge members, the blade volume occupied by the core cavity member (e.g. the pocket(s) or hollows as mentioned above), the blade volume of the bridge members, the number of any pockets, etc. may be varied, as desired, in any suitable (known) manner, in accordance with the resin-fiber material and structure desired to be used for the face and bridge members. However, the configuration and structure of the bridge member(s), connecting the face members together, must be such as to adequately maintain the structural integrity of the blade construct in light of the ultimate environment of use of the blade.

With the above in mind, a core cavity member may take on any configuration whatsoever. As a consequence, the bridge members may, similarly, also take on any configuration (e.g. be post-like, rib-like, etc, in configuration) or orientation (e.g. perpendicular, angled, etc.) between the first and second face members.

A bridge member may, for example, have a rib-like aspect. A rib bridge member may extend longitudinally of the blade construct; the word "longitudinally" is to be understood herein as characterizing a rib bridge member as being oriented such that the ends thereof are directed more or less towards the tip and heel regions of the blade as against being oriented towards the top and bottom of the blade, the bottom of the blade being the part thereof intended to ride along a (ice) surface. A rib bridge member may extend more or less the entire length of the blade (i.e. from about the tip region of the blade construct to about the heel region of the blade construct) or it may be of some intermediate length and be disposed therebetween. A rib bridge member may have a straight or curved aspect. A rib bridge member may extend longitudinally more or less parallel to the (effective) longitudinal axis of the blade construct; a rib bridge member may, however, if desired, extend at an angle to the longitudinal axis.

A blade construct may have one or more of such rib bridge members.

Thus, in accordance with a particular aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,

said rib bridge members extend longitudinally of said blade body,

said first face member, said second face member and said rib bridge members are integral, and

one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

As mentioned above, a core cavity member may take on any configuration whatsoever keeping in mind the above referred to aspects thereof. Accordingly, a core cavity member may comprise a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows (e.g. microhollows) so as to provide the core cavity member with a cellular structure. The hollows may be present in a size and number sufficient to provide the blade construct with the desired specific gravity, strength, etc. In this case, the bridge member of the core cavity member may comprise a single integral bridge body element having included within its structure the hollows as well as the transversally disposed fiber reinforcing component. Apart from the transverse members, the core cavity member may in this case include a fiber reinforcing component oriented more or less parallel to the face members of the blade.

Thus, in accordance with an additional aspect, the present invention provides a blade construct for a hockey stick or the like, said blade construct comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows so as to provide the core cavity member with a cellular structure,

said first face member, said second face member and said bridge body are integral, and

said bridge body comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with the present invention the expressions "fiber component which is oriented transversely", "transverse fiber component" and the like are to be understood as referring to a non-parallel orientation (relative to the face members) of fiber component, i.e. the spatial disposition of such fiber component is such that the fiber component (i.e. a length dimension) is in a non-parallel relation with respect to the face members. The transverse fiber component may of course be one component of a fiber reinforcement element embedded in the resin matrix of a bridge member; other fiber component(s) may be disposed in different fashion i.e. in a more or less parallel fashion with respect to the face members. A bridge member and/or transverse fiber component thereof may, for example, be Oriented so as to provide, when the blade construct is viewed in cross-section, an aspect which is more or less perpendicular to the face members or some other angled aspect such as for example an aspect which includes a 45 degree angle.

In accordance with the present invention, a fiber reinforcing element of a bridge member may be disposed solely in the body of the bridge member. Alternatively a component of a fiber reinforcing element of a bridge member may merge with or be connected to the fiber reinforcement element of one or both face members. Thus a fiber reinforcing element of a bridge member may, for example, have a fiber component (or components) which is (are) connected at one end thereof to

the transverse fiber reinforcement component while the other end of such coupler fiber component extends into the resin matrix of a face member, such end extension thus forming a component of the fiber reinforcement element of such respective face member. The fiber reinforcing element of a bridge member may, for example, comprise a part of a single continuous fiber body which includes all or part of the fiber reinforcing elements of the face members, i.e. the transverse fiber reinforcing component of a bridge member is connected to the fiber reinforcing elements of both face members. Accordingly, the word "connect(ed)" or the like (in relation to the transverse component) is to be understood herein in the context of such combinations.

Depending on the nature of the starting fiber material desired to be used to make the fiber reinforced composite blade construct, it may prove necessary, in order to obtain a desirable transverse orientation of a fiber component:, to subject the fiber reinforcement material of the intended bridge member to some degree of tension during curing (i.e. of the resin). The underlying purpose of maintaining some degree of tension or stretching during curing is to inhibit such fiber component from being embedded in the resin matrix in a collapsed or folded state; accordingly the degree of tension on the embedded fiber component to accomplish this purpose may be so negligible as to constitute no tension at all. However, it may be desired to provide significant tension to a fiber component of an intended bridge member in order to have a tensioned fiber reinforcing component which is oriented transversely to the face members; i.e. to obtain a sort of prestressed bridge member analogous to a prestressed rod reinforced concrete body wherein the rods are maintained under tension during curing of the concrete matrix. Accordingly, as used herein the words "tension", "tensioned", or the like, are to be understood as characterizing a fiber reinforcing element (which is embedded in a resin matrix), as having been subjected to a degree of tension during curing of the initial fiber/resin combination, the degree of tension being predetermined in light of the above.

The blade construct, of the present invention, may, for example, be incorporated into a replaceable blade section. The replaceable blade section may be provided with a spigot member for releasable, mating engagement with a slot in one end of a handle section; if desired the blade section may have such a slot for similar engagement with a spigot at the end of a handle section; see, for example, U.S. Pat. Nos. 4,600,192, 4,488,721, 4,358,113 and 3,934,875 which show such spigot/slot type engagement means (the entire contents of these patents are incorporated herein by reference). Alternatively, the blade construct may be integrally attached to a handle in any suitable (known) manner; for example the blade construct when formed may be directly fixed to the handle by fiber-reinforce plastics material (see for example U.S. Pat. Nos. 4,591,155 and 4,059,269, the entire contents of which are incorporated herein by reference). The handle section itself may take any suitable (known) form or configuration.

Thus, in accordance with a particular aspect of the present invention there is provided a hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises one or more bridge members of fiber reinforced plastics material,

said first face member, said second face member and said bridge members are integral, and

one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

In accordance with a further particular aspect the present invention provides a hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,

said rib bridge members extend longitudinally of said blade,

said first face member, said second face member and said rib bridge members are integral, and

each said rib bridge member comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

According to the present invention, the blade construct may be made in any suitable manner, whatsoever, provided that the necessary core cavity bridge structure is achieved for connecting the face members together. If desired a shaft may be secured to the blade construct by suitable resin impregnated fiber reinforcing plastics layers extending from the face members and the obtained green combination cured in a press mold to form the desired hockey stick.

In accordance with the present invention the fiber reinforced plastics material of the face and bridge members may be composed of a suitable (known) resin and a suitable (known) fiber reinforcement element; the resin may, for example, be a polyester or epoxy resin while the fiber reinforcement element may, for example, be of glass fibers, carbon fibers, organic (polyamide) fibers, etc. A fiber reinforcement element which may be used in the context of the present invention may take any suitable (known) form, such as, for example, fiber strands, a fabric (e.g. a woven or non-woven fabric), etc.

In accordance with the present invention the face members may be built up in any suitable (known) manner from resin and fiber reinforcement elements keeping in mind, however, the stress, shock, etc., to which they will be subjected during use. The fiber element may comprise one or more fiber (mat) layers.

The blade construct may, for example, be built up using a suitable preform which makes allowance for the formation of the required core cavity bridge structure.

If bridge members having the aspect of a plurality of longitudinally extending ribs are desired, a rib preform may, for example, comprise a channelled fabric of reinforcing fibers wherein interconnected fabric channels are disposed about suitable elongated support or filler members, the filler members being configured to tend to

maintain fibers of each channel disposed between adjacent filler members in a (tensioned) transverse orientation during the curing and shaping stage of the fabrication process i.e. transverse relative to the face members of the final product.

A reinforcing fabric for such a rib preform may, for example, comprise reinforcing fibers or fiber strands woven into a two layered channelled fabric; the warps of the two layers of fabric criss-crossing each other forming fabric channels between a pair of cross-over points.

The interconnected fabric channels of such a rib preform may be filled with flexible foam stripes of plastics material, thermoplastic rigid foam stripes, (removable) thin walled pressure hoses, etc.; e.g. strips of polyurethane foam, one or more slabs of polyurethane foam, etc. Under the desired curing conditions, a flexible or thermoplastic rigid foam must facilitate imparting to the blade construct, the shape and thickness of the mold form; e.g. a thermoplastic foam should soften at the mold temperatures used. If the channels are filled with pressure hoses these have to be able to be (de)pressurised during the molding operation so that the blade construct takes the thickness and shape of the mold.

Filler members may be disposed in the fabric channels during the weaving of the two layered fabric or can be disposed therein thereafter.

The channelled fabric for the above mentioned rib preform may be pre-impregnated with a suitable resin such as an epoxy resin or the like. The resin in the cross-over fabric region between adjacent filler members is intended-, once cured, to have imbedded therein a transverse fibre reinforcing component; i.e. in the cured hardened state this portion of the resin defines a resin matrix for the core cavity bridge members of the present invention which connect the face members together.

The above described rib preform, comprising the channelled fabric, the filler members and resin may be moulded into a hockey stick blade of the desired shape and thickness, any necessary or desired additional layers of resin impregnated reinforcing fabric being previously added to both of the opposed faces thereof.

After curing the reinforcing fabric elements and resin between the filler members form a composite bridge structure holding the spaced opposed face members together; the rib bridge members have a reinforcing fiber component extending therethrough transverse to the face members.

Instead of interconnected fabric channels a plurality of independent fabric covered foam strips may for example be used to make a rib preform. Thus stripes of flexible foam plastic, thermoplastic rigid foam or thin walled pressure hoses may be covered with a sock type of reinforcing fiber fabric. The weave of the fabric sock can be such that the webs thereof run in a controlled angle with respect to the longitudinal axis of the strip(s). For instance they may be at a 45 degree angle so as to enhance shear stress resistance. Several of these "sausages" type members, (the fabric thereof impregnated with a suitable resin) may be lain side by side sandwiched between outer layers of resin impregnated fabric and cured in a mold as mentioned above to provide a blade construct having core cavity rib bridge members.

Alternatively a rib preform may be constructed from several stripes of rigid foam which can be either preshaped or thermoplastic. A preimpregnated layer of reinforcing fiber fabric or mat may be lain about the strips in intertwining fashion so that the fabric runs along the first outer surface of a first strip, between the first strip and an adjacent second strip, over the second outer surface of the second strip, between the second stripe and a third stripe, along the first outer surface of the third strip and so on. The rest of the above example methodology may then be followed.

In accordance with a further possible preform structure, layers of reinforcing fiber fabric or mat may be knitted together with a plurality of reinforcing fiber thread or strands which run through both layers and which have a certain length such that the layers may be held apart from each other with a suitable springy distance holding member such as mentioned above; i.e. the knitting is loose enough to allow the layers to be spaced apart a certain distance. This three dimensional preform may then be placed into a mold which is filled with expanding polyurethane or epoxy resin, etc.

The joining of the blade construct to a hockey shaft or the like may take place in known fashion (see for example U.S. Pat. No. 4,059,269). Thus, for example resin impregnated fiber fabric may be disposed over each of the opposed face surfaces of a preform so as to provide flap portions which may extend over the tapered lower end of a hockey shaft, the end being configured to define part of the heel end of the intended blade. Thereafter, the whole may be cured in a pressure mold to harden the fiber reinforced layer about the end of the handle. The shaft may be of wood, of synthetic material or even a lightweight metal material such as aluminum.

Finally, the blade construct or hockey stick of the present invention may be worked to remove any excess glue material including fiber material that extends beyond the edges the blade. This can be done in a conventional manner such as by cutting, sanding or grinding. This method is well known in the art.

DESCRIPTION OF DRAWINGS

Example embodiments of the invention are illustrated by way of example only in the accompanying drawings wherein:

FIG. 1 is a schematic side elevation view showing a hockey stick incorporating an example embodiment of a blade construct in accordance with the present invention;

FIG. 2 is a cross-sectional view of the blade construct shown in FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 shows a cross-sectional view the same as that of FIG. 2 but illustrating an alternate structure for the blade construct having a wrap around bottom instead of a wear protection bottom piece;

FIG. 4 shows a detailed partial perspective view of the blade construct of the hockey stick of FIG. 1, wherein a portion of a face member is removed to expose a number of the bridge members and pockets of the core cavity member;

FIG. 5 illustrates a number of fiber support strips or fillers; FIG. 6 illustrates a channelled fabric of reinforcing fiber for incorporation into the bridge members as well as the face members of the example embodiment of a blade construct shown in FIG. 1;

FIG. 7 illustrates an intermediate assembly (i.e. rib preform) comprising the fabric and support strips as shown in FIGS. 5 and 6;

FIG. 8 shows a partial detailed view of an intermediate structure of a blade construct prior to curing;

FIGS. 9, 10 and 11 illustrate alternative example intermediate structures prior to curing for the formation of a blade construct in accordable with the present invention; and

FIG. 12 illustrates an example embodiment of a replaceable blade section which incorporates a blade construct of the present invention.

Referring to FIG. 1, a hockey stick blade is shown which incorporates a blade construct of the present invention. The stick comprises a handle section 1 and a blade section indicated generally by the reference numeral 2; for illustration purposes, only a portion of the handle 1 is shown. The blade section 2 comprises a blade construct of the present invention (as shall be explained hereinafter). The lower portion 3 of the handle 1 is attached to the blade section 2 by a fiber reinforced plastics material layer 4 shown as crossed hatching. Although it is not so shown the layer 4 extends right up to the tip 4a of the blade; a similar layer is disposed of the opposite face of the blade. These outer fiber reinforced plastic layers 4 form part of opposed face members of the blade construct as shall be seen below.

The blade as shown in FIG. 1 also includes a wear resistant member 5 for contacting the ice surface (see U.S. Pat. No. 3,982,760 for a further discussion of such members, the entire contents of this patent is incorporate herein by reference), this member may take the aspect of a thermoplastic wear protection bottom piece.

In FIG. 1, the rib bridge members are shown in longitudinally extending outline by the dotted lines 6 (in FIG. 1, only one of the longitudinally extending dotted lines is so designated).

Turning to FIG. 2, this figure shows a cross-section of the blade construct of the ice hockey stick illustrated in FIG. 1. For illustration purposes, the fiber elements, which are part of the structure of the blade, are not shown. As can be seen, the blade has a first face member 7 and a second opposed face member 8. The core cavity member comprises the rib bridge members designated by the reference numerals 9, 10, 11, 12, 13 and 14 and includes elongated pockets 15, 16, 17, 18, 19 and 20 (see also FIG. 4); as may be seen, the elongated pockets are delineated by respective portions of the opposed face members and by the rib bridge members.

FIG. 3 illustrates a blade structure which is essentially the same as that of the blade structure shown for FIGS. 1 and 2, except that this alternate blade structure does not include a lower wear resistant member 5; in its place, there is a further pocket 21 (since the structure of the embodiment illustrated by FIG. 3 is essentially the same as that embodiment shown in FIGS. 1 and 2, the same reference numerals have been used with respect thereto to designate the various elements thereof).

Referring to FIGS. 2 and 4, FIG. 4 shows a partial perspective view of a portion of the blade body indicated generally by the arrow designated 22 in FIG. 2.

As can be seen from FIGS. 2 and 4, the various rib bridge members and the face members are configured such that they delineate the pockets 15 to 20. The rib bridge members extend longitudinally of the blade in the manner illustrated generally by the dotted lines 6 in FIG. 1. Each pocket is spaced or separated from an adjacent pocket by a corresponding rib bridge member; for example, the pockets 16 and 17 are separated from each other by the bridge member 10. The pockets as seen also extend longitudinally of the blade. The pockets are closed off at the tip 4a by fiber reinforced material and at the heel region by the lower portion 3 of the handle 1.

As mentioned above, the face members 7 and 8 as well as the bridge members 9 to 14 and the tip 4a are of a fiber reinforcement plastic material. In FIGS. 2, 3 and 4, only the basic structure is shown without any attempt to show the disposition of fiber elements or components embedded in the resin matrix structure.

FIGS. 2 and 3, for illustration purposes only, show the pockets as being hollow or empty. Although this is a possible version of the core cavity member, the pockets for the embodiment (s) shown in FIGS. 1 to 4 may be filed with a light (polyurethane) foam material (not shown) not intended to provide structural support for the blade construct but for maintaining a fiber component in the bridge member in a transverse (e.g. tensioned) configuration during curing (as shall be explained hereinafter).

A blade construct having longitudinally extending rib bridge members and elongated pockets having light foam material disposed therein may be built up using example intermediate structures such as illustrated in FIGS. 5, 6, 7 and 8.

Referring to FIGS. 5, the intermediate structures for building up the required bridges members include a number of elongated filler strips or inserts 22 (only three are shown and not in their entire length). As mentioned above the strips 22 may be of flexible foam or thermoplastic rigid foam which softens during moulding such that in either case the final intermediate structure may be shaped and cured in a pressure mould to provide the blade construct of desired shape and thickness. The foam strips 22 are disposed such that they are spaced apart so as to leave spaces 23 between adjacent foam strips 22. The strips 22 are maintained in this position by being engaged in respective elongated channels defined by a two layered fabric material which is woven into a channelled fabric having a plurality of elongated channels.

Referring to FIG. 6, a portion of such a channelled fabric is shown. As can be seen, each of the channels of the fabric is formed by opposed cross-over weave members designated 24 and 25 and upper and lower weave members 26 and 27 which connect up with the cross-over weave members 24 and 25. The channelled fabric comprises a plurality of interwoven fiber (e.g. glass) strands and is impregnated with a suitable resin (e.g. an epoxy resin). Some of the strands of fabric run parallel to the lengthwise dimension of the channels, while a second set of strands run perpendicular to the lengthwise dimension i.e. the perpendicularly running strands of the cross over members are to be disposed transverse to the face members in the blade construct.

FIG. 7 illustrates a portion of an example embodiment of a rib preform comprising the fabric and strips of FIGS. 5 and 6. As can be seen, the spaces 23 between the strips 22 are occupied by cross-over fiber members (e.g. cross-over members 24 and 25). As may also be appreciated, the cross-sectional thickness of the strips 22 is such that they fill the elongated channels of the channelled fabric sufficiently to maintain the perpendicular strands of the cross-over members 24 and 25 in a (e.g. tensioned) transverse state during curing of the resin. Sufficient resin is pre-applied to the channelled fabric such that after curing, the spaces between the strips 22 are occupied by a fiber reinforcing plastic material defining the rib bridging members which connect the face members 7 and 8 together. The number of

channel/strip pairs for building the blade construct of FIG. 1 is six. The longitudinal length of the channel/-strip pairs is sufficient to provide a blade body having the desired length; the channel/strip pairs for the example blade construct are disposed so as to provide bridge members of a more or less longitudinally straight aspect; the channel/strip members may of course be configured to provide a desired longitudinal extending curved aspect i.e. the bridge members still effectively extending longitudinally as described above. The channel fabric of each of the end or outermost channel/strip members of the preform may be tied off or connected at the junction of the crossover members (i.e. terminated) in any suitable manner since there is no adjacent strip around which the fabric to be wrapped.

A rib preform as illustrated in FIG. 7 is, thereafter, as shown in FIG. 8 (only five of the six channel/strip pairs for the blade construct of FIG. 1 are shown), overlain with reinforcing fabric layers 28 and 29 i.e. the channelled fabric and foam strip combination is sandwiched between the reinforcing fabric 28 and 29. The reinforcing fabric 28 and 29 is also impregnated with a suitable resin. In the embodiment shown, the face members 7 and 8 of the cured construct will comprise the respective reinforced plastic layers 28 and 29 as well as the portions 26 and 27 of the channel/strip members of the rib preform.

The fabric 28 and 29 are sized to extend beyond the outer edges of the rib preform. In this manner the top member and tip member of the blade may be formed by molding and curing the excess fabric to wrap around these areas of the blade core; the excess material being removed (e.g. by grinding, etc.) after curing.

A wear resistant (e.g. thermoplastic) member 5 is disposed adjacent to an end channel/strip member, the excess reinforced plastic layers 28 and 29 in this region being disposed to overlap the resistant members 5 (see FIG. 8) so that the member 5 will be fixed to and form part of the bottom member of the blade structure (see for example U.S. Pat. No. 3,982,760 with respect to the incorporation of a lower resistant member into a hockey blade).

With respect to the hockey stick embodiment as shown in FIG. 1, the heel end of the final intermediate structure may be configured as shown in FIG. 1 so as to matingly contact with the lower end 3 of the handle section 1. Thus the excess reinforcing plastic layers 28 and 29 in this region of the intermediate structure will be extended to overlap the handle portion 3 so that the entire stick may be placed into a suitably formed mold and the handle immediately formed integral with the blade construct during curing of the blade construct. In FIG. 1, the overlapping portion or region of the fiber reinforced layers 28 is designated or referred to by the reference numeral 4*b*. The handle member may be of wood, of a composite material, etc.

The combined elements as shown in FIG. 8 is thereafter cured (along with the handle element) using a mould which will subject the combination to a suitable temperature and pressure for curing the resin and shaping the blade construct into the shape and thickness of a desired blade for a hockey stick.

After curing, the perpendicular rib bridge members will consist of a cured resin having embedded therein the criss-cross weave members (e.g. members 24 and 25) with the strands thereof extending transversally with respect to the face members 7 and 8 (see for example the element designated by the reference number 24*a* in FIG. 8). Once the precursor combination is cured, the elongated pockets of the core cavity member will each be filled with a respective foam strip material. For this embodiment, the rib bridge members are more or less parallel to the longitudinal axis of the blade construct; the rib bridge members could of course extend longitudinally with respect to the blade construct at some angle to the longitudinally axis 36 (see FIG. 1).

Referring to FIG. 12 (on the same sheet of drawings as FIG. 1), instead of a complete handle section 1 being integrally fixed to the blade construct, a handle heel portion 30 having a spigot member 31 may be so fixed to the blade construct. In this way, a replaceable blade section may be obtained which can thereafter matingly and replaceably be fixed to a handle having a corresponding slot at one end thereof.

Referring to FIG. 3, the wear member 5 may be omitted. In this case the bottom running or sliding edge of the blade may be formed by the excess fiber reinforced fabric layers 28 and 29 in this region of the intermediate structure. Thus, during moulding, the fiber reinforced layers of this excess region are (as in the case of the top and tip regions) pinched towards each other and cured any excess material being thereafter removed to obtain the desired shape of the bottom member of the blade.

Referring to FIG. 9, this figure shows another possible rib preform for making the blade construct wherein rib bridge members 5 have embedded therein fiber elements which extend transversally with respect to the face members of the construct. In the preform embodiment shown, the flexible strips 32 are covered with a sock type reinforcing fabric 33. The webs of the sock fabric 33 can run at a controlled angle (e.g. 45°) with respect to the longitudinal axis of the strips (i.e. the weave is of a criss-cross configuration). The fibers of the sock of each of these individual sausage like channel/strip elements may be impregnated with a suitable resin. In order to make the blade construct a number of these appropriately sized and configured "sausages" may be lain side by side sandwiched between appropriate reinforced plastic layers 34 and 35. The sausages are laid side by side so as to obtain a blade construct wherein the bridge members extend longitudinally of the blade construct therebetween.

A FIG. 10 shows a further possible way of building up rib bridge members having the required transverse fiber elements embedded therein. In this rib preform embodiment, a number of strips of rigid foam are disposed side by side such that a single preimpregnated layer of reinforcing fiber fabric or material 38 is layered or intertwined in a continuous fashion around these core strips such that the layer runs from a first side of one strip down between adjacent strips to the opposite surface of the adjacent strip, etc. The blade construct of this version also includes fiber reinforcing fabric layers 39 and 40 such that the blade construct may be cured as mentioned above.

Returning to FIG. 11, this Figure shows a further possible structure for the intermediate fabric thermoplastic strip combination. In this case, the upper and lower (resin impregnated) fabric layers 41 and 42 respectively are spaced apart by a suitable (rigid) foam material 43 (partially shown) such as for example a polyurethane foam slab. The upper and lower fabric layers 41 and 42 are then knitted together by strands 44 of fiber material. The foam slab will hold apart the reinforcing fiber layers 41 and 42 during curing and

moulding so as to obtain the required bridge members spacing the facing members apart and which have transversally extending fabric strands embedded in the bridge members. In this case, the bridge members will take on a post-like configuration since during curring resin will flow by capillary action over the transverse strands or threads **44** such that on curring the threads will be encased in a resin matrix, i.e. the core cavity member will have a plurality of spaced bridge members of post-like configuration.

In accordance with an alternative form for the structure shown in FIG. **11** the foam material **43** may be replaced by a core member which is built up starting from a plurality of layers (e.g. three or more) of reinforcing fiber material. However, at least one of the reinforcing fiber layers of the core cavity member of this structure comprises thermoplastic hollow (micro)spheres which are embedded in the interstices between the fiber. These hollow (micro)spheres serve as a type of filler in order to reduce the specific gravity of the final construct; the (micro)spheres may be present in any desired number and size keeping in mind the role of the spheres is to provide the central core with pockets of empty spaces so as to reduce the (specific) weight of the construct while providing a construct with an acceptable level of strength, resistance, etc. The hollow spheres, may, for example, have a size ranging from 0.01 mm to 0.05 mm.

Suitable types of laminateable core material comprising microspheres are available from Spezialprodukte fur Leichtlaminaten GmbH, Germany. These products are sold under the names "Spherecore" and/or "Spheremat"; these products comprise glass fiber and thermoplastic hollow microspheres disposed in the interstices of the fibers.

In accordance with this alternate structure, suitable numbers of central layers are laid on top of each other keeping in mind the desired thickness of the blade. The layers may all comprise fiber material with the thermoplastic spheres or some of the layers as desired may comprise conventional fiber layers without such spheres; the proportion of the various types of layers will depend on the specific gravity it is desired to have in the end product. As in the case of the embodiment illustrated in FIG. **11**, outside layers **41** and **42** would be provided which would be stitched together through the central core fiber layers using a suitable thread like material (e.g. glass fiber or some other high modulus fiber) in order to form the transverse fiber reinforcing component connecting the first surface layer to the second surface layer.

Thereafter, the over all combination may be impregnated with a low viscosity epoxy or polyester resin and then cured and pressed in a mould to the desired shape of the hockey stick blade. The cured plurality of central layers of fiber mat or woven fabric would provide the basic core cavity member with a cellular structure, i.e. a structure comprising a plurality of hollows or cavities.

With this latter type of structure, the specific gravity of the blade may, for example, be reduced to a level of about 0.85. The amount of the layer material comprising the microspheres may be determined in light of the desired degree of weight, stiffness and strength desired in the final structure.

What is claimed is:

1. A blade construct for a hockey stick, said blade construct comprising a blade body having
- a first face member, and
- a second opposed face member,
- said first and second face members being spaced apart and being of fiber reinforced plastics material,
- characterized in that,
- a core cavity member is sandwiched between said first and second face members,
- said core cavity member comprises one or more bridge members of fiber reinforced plastics material,
- said first face member, said second face member and said bridge members are integral, and
- one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

2. A blade constrict as defined in claim **1** characterized in that said cavity member comprises a plurality of said bridge members and a plurality of the bridge members comprise a fiber reinforcing component oriented transversely with respect to said first and second face members.

3. A blade construct as defined in claim **1** characterized in that said cavity member comprises a plurality of said bridge members, each of the bridge members of said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

4. A blade construct as defined in claim **1** characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

5. A blade construct as defined in claim **1** characterized in that one or more of said bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

6. A blade construct as defined in claim **3** characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

7. A blade construct as defined in claim **5** characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

8. A blade construct for a hockey stick, said blade construct comprising a blade body having
- a first face member, and
- a second opposed face member,
- said first and second face members being spaced apart and being of fiber reinforced plastics material,
- characterized in that,
- a core cavity member is sandwiched between said first and second face members,
- said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,
- said rib bridge members extend longitudinally of said blade body,
- said first face member, said second face member and said rib bridge members are integral, and
- one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

9. A blade construct as defined in claim **8** characterized in that said cavity member comprises a plurality of said rib bridge members, each of the bridge members of

said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

10. A blade construct as defined in claim 8 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

11. A blade construct as defined in claim 8 characterized in that one or more of said rib bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

12. A blade construct as defined in claim 9 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

13. A blade construct as defined in claim 11 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

14. A blade construct as defined in claim 9 characterized in that each said rib bridge member comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members and each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

15. A hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises one or more bridge members of fiber reinforced plastics material,

said first face member, said second face member and said bridge members are integral, and

one or more of said bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

16. A hockey stick as defined in claim 15 characterized in that said cavity member comprises a plurality of said bridge members and a plurality of the bridge members comprise a fiber reinforcing component oriented transversely with respect to said first and second face members.

17. A hockey stick as defined in claim 15 characterized in that said cavity member comprises a plurality of said bridge members, each of the bridge members of said plurality of bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

18. A hockey stick as defined in claim 15 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

19. A hockey stick as defined in claim 15 characterized in that one or more of said bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

20. A hockey stick as defined in claim 17 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

21. A hockey stick as defined in claim 19 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

22. A hockey stick comprising a handle and a blade, said blade comprising a blade body having

a first face member, and

a second opposed face member,

said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a plurality of spaced apart rib bridge members of fiber reinforced plastics material,

said rib bridge members extend longitudinally of said blade,,

said first face member, said second face member and said rib bridge members are integral, and

one or more of said rib bridge members comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

23. A hockey stick as defined in claim 22 characterized in that said cavity member comprises a plurality of said rib bridge members, each of the rib bridge members of said plurality of rib bridge members comprising a fiber reinforcing component oriented transversely with respect to said first and second face members.

24. A hockey stick as defined in claim 22 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of at least one of said first and said second face members.

25. A hockey stick as defined in claim 22 characterized in that one or more of said rib bridge members comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

26. A hockey stick as defined in claim 23 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

27. A hockey stick as defined in claim 25 characterized in that, each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

28. A hockey stick as defined in claim 23 characterized in that each said rib bridge member comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members and each transversely oriented fiber reinforcing component is connected to a fiber reinforcing component of said first face member and of said second face member.

29. A blade construct for a hockey stick, said blade construct comprising a blade body having

a first face member, and

a second opposed face member, said first and second face members being spaced apart and being of fiber reinforced plastics material,

characterized in that,

a core cavity member is sandwiched between said first and second face members,

said core cavity member comprises a bridge body of fiber reinforced plastics material having dispersed therein a plurality of hollows so as to provide the core cavity member with a cellular structure,

said first face member, said second face member and said bridge body are integral, and

said bridge body comprises a fiber reinforcing component oriented transversely with respect to said first and second face members.

30. A blade construct as defined in claim 29 characterized in that said hollows are microhollows.

31. A blade construct as defined in claim 29, characterized in that the bridge body comprises a tensioned fiber reinforcing component oriented transversely with respect to said first and second face members.

* * * * *

US006039661A

United States Patent [19]

Christian et al.

[11] **Patent Number: 6,039,661**

[45] **Date of Patent: Mar. 21, 2000**

[54] **REINFORCED HOCKEY REPLACEMENT BLADE AND METHOD OF MAKING THE SAME**

[75] Inventors: **William D. Christian; Roger A. Christian**, both of Warroad, Minn.

[73] Assignee: **Christian Brothers, Inc.**, Warrod, Minn.

[21] Appl. No.: **08/906,599**

[22] Filed: **Aug. 6, 1997**

[51] **Int. Cl.**^{7} **A63B 59/14**

[52] **U.S. Cl.** **473/562**; 473/561; 473/563

[58] **Field of Search** .... 473/562, 563, 473/561, 560, FOR 189

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Primary Examiner—Mark S. Graham

[57] **ABSTRACT**

A reinforced hockey replacement blade having a pair of reinforcement strips extending from the outermost end of the connection end past the point at which the replacement blade is connected with the handle and embedded within a recessed area of the replacement blade. The invention also relates to a method for making such a replacement blade.

15 Claims, 5 Drawing Sheets

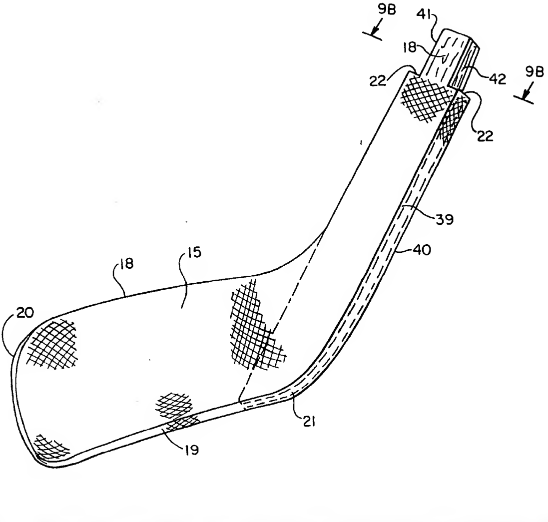


Fig. 1

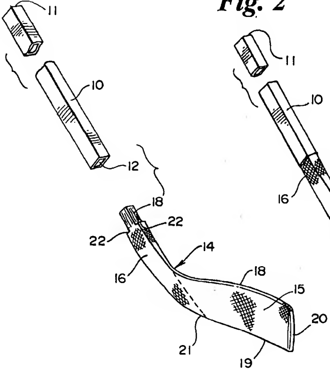


Fig. 2

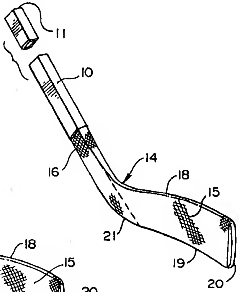


Fig. 3

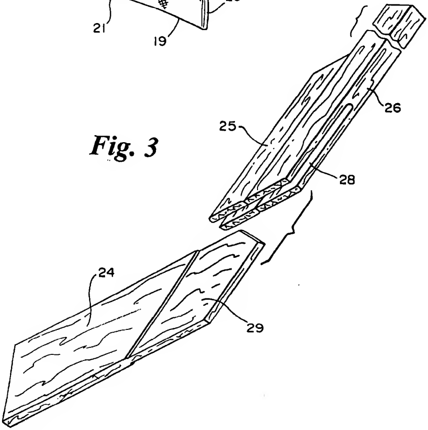


Fig. 4

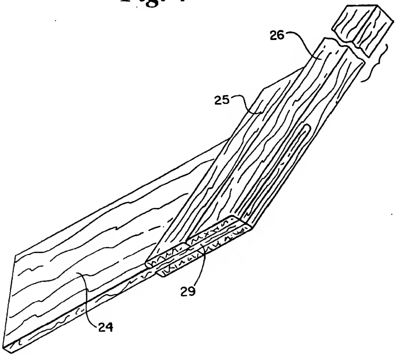


Fig. 5

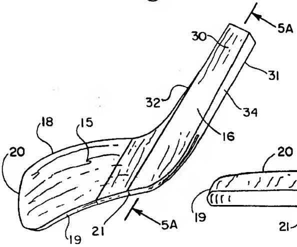


Fig. 5A

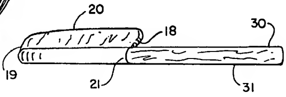


Fig.6

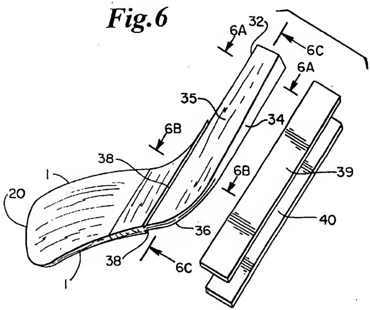


Fig6A

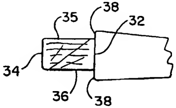


Fig6B

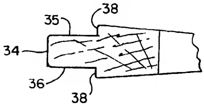


Fig.6C

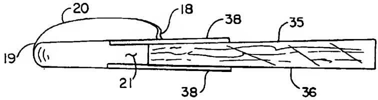


Fig. 7

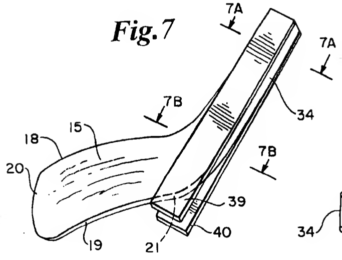


Fig. 7A

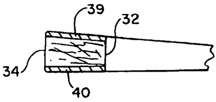


Fig. 7B

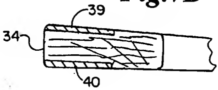


Fig. 8

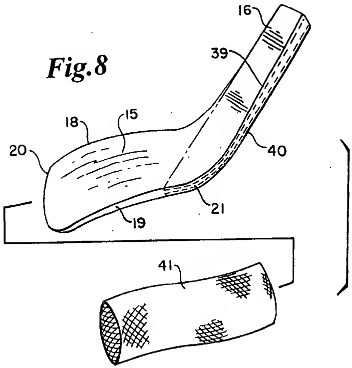


Fig. 9

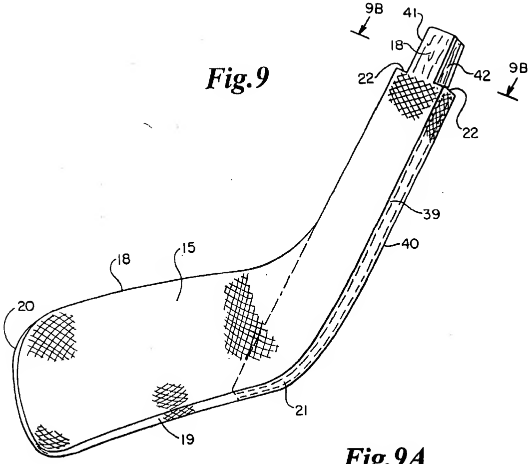


Fig. 9A

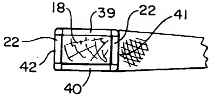
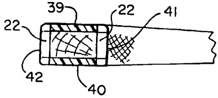


Fig. 9B



REINFORCED HOCKEY REPLACEMENT BLADE AND METHOD OF MAKING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to the field of hockey sticks and the like, and more particularly, to a reinforced hockey replacement blade adapted for connection to and use with a hockey stick handle. The invention also relates to a method of making such a replacement blade.

2. Description of the Prior Art

Ice hockey sticks have experienced dramatic changes throughout the years. Specifically, ice hockey sticks have evolved from plain wooden sticks having a straight blade and handle to significantly improved sticks having a curved blade and fiberglass reinforcement.

The construction of the stick has also evolved substantially. Initially, the handle and blade portions were both constructed of wood and were integrally joined with one another through various processes so that the blade and the handle were essentially a single, integral unit. As technology developed, metal handles, particularly aluminum handles, were introduced and more recently, plastic or composite handles have also been introduced. Both aluminum and plastic or composite handles are elongated and generally hollow, and are secured to a replacement blade by a heat sensitive adhesive.

A typical replacement blade includes a blade portion, a shaft portion and a connection end. The blade portion includes a toe end and a heel end. The shaft portion begins at the heel and extends upwardly to the connection end. The connection end is designed and shaped for insertion into the lower end of the aluminum or plastic handle where it is retained by the heat sensitive adhesive. The blade and shaft portions of the replacement blade are commonly covered with a reinforcement material to improve the strength and durability of these areas. One reinforcement technique involves providing a sheet of fiberglass or other reinforcing material and folding or wrapping the sheet around the blade and shaft portions. Another reinforcement technique involves the use of a sleeve of braided fiberglass or other reinforcing fibers as shown in Canadian Patent No. 1,138, 912 issued in 1983 to Harwell. In both cases, a curable resin is applied to the reinforcement material to bond such material to the replacement blade. After the resin cures, excess reinforcement material is removed by sanding and the shaft end of the replacement blade is cut or routed to form a shoulder and thus the connection end. During formation of the connection end, a portion of the wood and reinforcement material is removed to provide the connection end with the proper configuration and dimensions for insertion into the hollow end of the metal or plastic handle.

Although metal and plastic hockey stick handles with connected replacement blades function satisfactorily, and have been generally positively received by hockey players, there has been a tendency for the connection end of the replacement blade to break at or near the point at which the blade is secured at the lower end of the handle. This tendency to break is due in large measure to the necessary removal of the reinforcement material and a general narrowing of dimensions at the connection end to enable its insertion into the handle. The problem is further compounded by the continuing popularity of the slapshot and the emergence of bigger and stronger players, both of which result in greater stresses being placed on the hockey stick.

Experience has generally shown that the weakest point of a replacement blade is usually at the point at which the blade joins with the lower end of the handle.

This problem has been previously recognized and various attempts have been made to reinforce the replacement blade at the point of connection. For example, U.S. Pat. No. 3,934,875 issued to Easton et al., uses a tapered metal shank which mates with a rectangular tubular shaft or handle to form a bond between the handle and blade. In U.S. Pat. No. 4,358,113 issued to McKinnon et al., a double box beam shaft in which a pair of fiberglass rods are positioned to provide reinforcement through the heel and neck portions of the blade. Both of these solutions require a plastic or fabricated blade. Thus, they are not applicable to wooden blades.

A solution applicable to wooden blades is shown in U.S. Pat. No. 5,496,027 issued to Christian, et al. In this patent the fabric fiberglass or other reinforcement material is extended up over the hozel or connection end of the replacement blade and then a clamp or molding device is utilized to provide the final configuration to the connection end. Still other proposed solutions have simply involved securing reinforcement material in the form of reinforcement strips to the sides of the connection end so that the strips extend downwardly past the connection point and onto a side portion of the replacement blade. However, in this latter solution, the final sanding step results in much of the reinforcing material being removed as the material is sanded to make it substantially flush with the wood portion of the blade to which it is connected. The reduces the benefit of the reinforcement material. Further, this solution of ten merely results in a transfer of the weak point of the replacement blade from its connection point to some other location.

Accordingly, a need continues to exist in the art for a hockey replacement blade useable with an aluminum or plastic hockey stick handle in which the connection end as well as the remainder of the replacement blade is reinforced to minimize breakage in a cost effective and efficient manner.

SUMMARY OF THE INVENTION

The present invention relates to an improved, reinforced hockey stick and a method of making the same. More particularly, the present invention relates to a replacement blade for a hockey stick handle with improved reinforcement in the area between the hozel or connection end and between the hozel and the bottom edge of the blade.

More particularly, the replacement blade of the preferred embodiment comprises a blade which includes top and bottom edges, toe and heel ends and front and back sides and a shaft which is integrally connected with, and extends outwardly and upwardly from, the blade. The uppermost end of the shaft is provided with a hozel or a shaft connection end which is adapted for insertion into and connection with the hollow lower end of a hockey stick handle.

In the preferred embodiment of the present invention, the blade and shaft are constructed of wood and a recessed area is formed on each side of the shaft to receive an elongated reinforcement strip. This recessed area preferably extends from the uppermost end of the hozel all the way to the bottom edge of the blade at the heel end. The replacement blade further includes a shoulder in the front and back edges of the shaft portion to define the connection end. Secured within the recessed areas by appropriate adhesive are reinforcement strips which, in the preferred embodiment, extend from the free end of the connection end to the bottom edge

of the blade. Thus, the reinforcement strips on each side of the replacement blade form the outer side surface of the connection end as well as the outer side surfaces of the shaft and a portion of the blade. The reinforcement strips have a thickness approximating the depth of the recessed areas. Thus, when the replacement blade is fine sanded or finished sanded, a minimum amount of reinforcement material is removed. If preferred, the blade and shaft portions can then be further wrapped or reinforced with woven or braided reinforcement fabric in a manner conventional in the art.

The method of making a replacement blade in accordance with the present invention involves first forming a rough cut and rough sanded replacement blade from woodstock in a conventional manner. A recessed area is then formed in each side of the rough cut replacement blade with a router, a milling device or some other cutting means. In the preferred embodiment, these recessed areas are formed on the sides of the shaft and blade portions and extend from the uppermost end of the shaft portion to the bottom edge of the blade at the heel end. An elongated reinforcement strip of relatively stiff plastic such as unidirectional fiberglass is then applied in the recessed area and secured thereto by an appropriate adhesive. After finish or fine sanding and further reinforcement with fiberglass fabric or the like in a manner known in the art, shoulder portions are then formed in the front and back edges of the upper end of the shaft portion to define the connection end.

Accordingly, it is an object of the present invention to provide an improved, reinforced hockey stick having a stick handle and a reinforced replacement blade. The replacement blade includes a blade portion, a shaft portion and a reinforced connection end.

Another object of the present invention is to provide a replacement blade for a hockey stick handle which is reinforced by reinforcement strips in recessed areas on the sides of the shaft and blade to limit breakage at the point of connection with the handle and throughout the replacement blade.

A further object of the present invention is to provide a replacement blade for a hockey stick having a connection end which is reinforced by a reinforcement strip in a recessed area extending from the free end of the connection end to the bottom edge of the blade and forms both the outer surface of the connection end and the outer surface of the shaft.

A still further object of the present invention is to provide a method of making a replacement blade of the type described above.

These and other objects of the present invention will become apparent with reference to the drawings, the description of the preferred embodiment and method, and the appended claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded isometric view of a hockey stick incorporating the reinforced replacement blade of the present invention.

FIG. 2 is an isometric view of a hockey stick similar to FIG. 1 in which the replacement blade has been connected to the hockey stick handle.

FIG. 3 is an exploded isometric view showing initial woodstock pieces in the manufacture of the replacement blade of the present invention.

FIG. 4 is an isometric view similar to that of FIG. 3 with the woodstock pieces connected with one another.

FIG. 5 is an isometric view of a rough cut and sanded replacement blade.

FIG. 5A is a view partially in section as viewed along the section line 5A—5A of FIG. 5.

FIG. 6 is an exploded isometric view showing a further step in the manufacture of the replacement blade in accordance with the present invention.

FIG. 6A is view partially in section as viewed along the section line 6A—6A of FIG. 6.

FIG. 6B is a view partially in section as viewed along the section line 6B—6B of FIG. 6.

FIG. 6C is a view partially in section as viewed along the section line 6C—6C of FIG. 6.

FIG. 7 is an isometric view showing a further step in the manufacture of the replacement blade in accordance with the present invention.

FIG. 7A is a view partially in section as viewed along the section line 7A—7A of FIG. 7.

FIG. 7B is a view partially in section as viewed along the section line 7B—7B of FIG. 7.

FIG. 8 is an exploded isometric view of a replacement blade in accordance with the present invention after being finish sanded and showing the application of fabric reinforcement to the outside of the replacement blade.

FIG. 9 is an isometric view of the finished replacement blade of the present invention.

FIG. 9A is an elevational top view of the connection end of the finished replacement blade of FIG. 9.

FIG. 9B is a view partially in section as viewed along the section line 9B—9B of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENT AND METHOD

The hockey replacement blade of the present invention has particular applicability for use with an aluminum, plastic or composite handle. When fully assembled and used, the present invention also relates to a hockey stick with an attached replacement blade in which the blade is provided with improved reinforcement to prevent breakage at the point where the replacement blade is connected with the hockey stick handle as well as throughout a major portion of the replacement blade. As shown in FIGS. 1 and 2, the hockey stick of the present invention includes an elongated handle **10** having a lower or blade connecting end **12** and an upper or free end **11**. The handle **10** is preferably hollow throughout its entire length; however, in some embodiments, a portion of the handle **10** can be filled with a lightweight foam or other material to provide desired flex or stiffness characteristics to the handle. At least the lower end **12** of the handle **10** is hollow and is adapted to receive the connection end of a replacement blade. The handle **10** is commonly constructed of a light weight metal such as aluminum or a plastic or composite material.

The replacement blade **14** of the present invention includes a blade or blade portion **15**, a shaft or shaft portion **16** and a connection end **18**. The blade portion **15** includes top and bottom edges **18** and **19**, a toe end **20** and a heel end **21**. A pair of blade sides extend between the top and bottom edges **18** and **19** from the toe end **20** to the heel end **21** on each side of the blade **15** and are commonly referred to as the front and back or forehand and backhand sides of the blade. The shaft portion **16** is integrally connected with the blade portion **15** and extends upwardly and outwardly from the heel end **21**. The uppermost end of the shaft **16** has a

generally rectangular cross-sectional configuration defined by a pair of side surfaces and front and back edges. As will be described in greater detail below, the sides surfaces of the shaft **16** taper inwardly as they join the front and back sides of the blade **15** and the front and back edges of the shaft **16** curve as they extend downwardly to join the top and bottom edges **18** and **19**, respectively, of the blade **15**.

The outer or uppermost end of the shaft **16** is provided with a connection end or hozel **18** which is adapted for insertion into, and connection with, the lower end **12** of the handle **10**. The connection end **18** has a generally rectangular configuration substantially confirming in size and configuration to the interior size and configuration of the end **12** to permit the end **18** to be inserted into the end of the handle in a tight fitting relationship. As is common in the art, the connection end **18** is provided with a heat sensitive adhesive to assist in securing the connection end **18**, and thus the replacement blade **14**, to the handle **10**. As shown best in FIG. **1**, the hozel or connection end **18** is defined by and separated from the shaft portion **16** by shoulders **22,22** formed in the front and back edges of the shaft portion **16**. The shoulders **22,22** limit the distance which the hozel **18** can be inserted into the lower end **12** of the handle **10**.

FIGS. **1** and **2** disclose the general structure of the replacement blade of the present invention. FIGS. **3–9** together with their related sectional and elevational figures disclose the method of making the replacement blade in accordance with the present invention and illustrate the structural elements of the replacement blade in further detail.

The first step in the method of making the replacement blade in accordance with the present invention is to prepare a rough cut replacement blade such as that illustrated in FIG. **5**. Various processes are known in the art for making such a structure. Any one of these can be utilized in making the replacement blade of the present invention. The preferred method in accordance with the present invention is to provide various woodstock pieces in the form of a wooden bladestock **24**, a wooden block **25** and a wooden shaftstock **26** as shown in FIG. **3**. The block **25** and the shaftstock **26** are formed from conventional handle stock, are glued together along adjacent edges and are provided with a generally tapered slot or mortise **28** as shown. The bladestock **24** is a generally flat, planar piece of wood which is provided with a tongue area or tenon **29** of reduced thickness for insertion into the slot **28** where it is retained by an appropriate adhesive. The assembly and gluing of the pieces **24**, **25** and **26** result in the rough blade configuration as illustrated in FIG. **4**.

The next steps in the process are to cut and shape the rough blade configuration of FIG. **4** on a profiler, to rough sand the blade and shaft and to provide the blade with the desired curve. This results in the rough cut replacement blade illustrated in FIGS. **5** and **5A**. The rough cut replacement blade comprises the blade portion **15** and the shaft portion **16**. The blade portion **15** includes top and bottom edges **18** and **19**, toe and heel ends **20** and **21** and side surfaces **13** and **17**. The shaft portion **16** extends upwardly from the blade **15** and has a generally rectangular configuration at its upper end defined by a pair of side surfaces **30** and **31** and front and back edges **32** and **34**, respectively. As shown in both FIGS. **5** and **5A**, the side surfaces **30** and **31** taper inwardly as they join with the side surfaces **13** and **17** of the blade portion **15**. The front and back edges **32** and **34** curve as they join with the top and bottom edges **18** and **19**, respectively, of the blade **15**.

The next step in accordance with the method of the present invention is to provide the rough cut blade of FIG. **5** with recessed areas or reinforcement strip receiving areas **35** and **36** as shown in FIGS. **6**, **6A**, **6B** and **6C**. These recessed areas **35** and **36** are milled out with an appropriate milling or cutting tool and are positioned on each side of the rough cut replacement blade. In the preferred embodiment, the recessed areas **35** and **36** extend from the outermost end of the shaft portion **16** to the bottom edge **19** of the blade **15**. As shown best in FIGS. **6** and **6A**, the recessed areas **35** and **36** at the upper end of the shaft portion **16** extend over the entire side surfaces **30** and **31** of the shaft **16**. As the recessed areas **35** and **36** approach the blade portion, they are defined by a straight-lined shoulder **38** on each side of the blade. As further shown in FIGS. **6** and **6A**, the shoulders **38** are generally in line with the front edge **32** of the shaft portion **16**. As shown in FIG. **6C**, the recessed areas **35** and **36** follow the contour of the shaft sides **30** and **31** and their transition with the blade sides **13** and **17**. Thus, the recessed areas **35** and **36** taper inwardly as they approach the bottom edge **19** of the blade portion **15**. After the recessed areas **35** and **36** have been milled or cut as shown in FIG. **6**, a pair of elongated reinforcement strips **39** and **40** are positioned within the recessed areas and secured thereto by an appropriate adhesive as shown in FIGS. **7**, **7A** and **7B**. Preferably the thickness dimension of the reinforcing strips **39** and **40** approximates the depth dimension of the recessed areas **35** and **36** so that when the strips **39** and **40** are applied and positioned within the areas **35** and **36**, their outer surfaces are substantially flush with the sides **13** and **17** of the blade adjacent to the shoulders **38**. In the preferred embodiment, these strips **39** and **40** have a thickness of about 0.5 to 2.0 mills and most preferably a thickness of about 1.0 mill. It is also preferable that the reinforcing strips **39** and **40** have a width dimension which approximates the width of the sides **30** and **31** near the upper end of the shaft **16** so that the edges of the strips **39** and **40**, when applied, are substantially flush with the front and back edges **32** and **34** of the shaft **16**. The length dimension of the strips **39** and **40** in the preferred embodiment should be sufficient by long to extend from the uppermost end of the shaft **16** to the intersection between the shoulders **38** and the bottom edge **19** of the blade **15**.

It is contemplated that a variety of different types of material may be utilized for the reinforcing strips **39** and **40**; however, such material should be sufficiently strong to provide increased reinforcement strength to the replacement blade. In particular, it should exhibit sufficient reinforcement strength to minimize breakage not only at the point of connection with the handle, but also at points continuously along the strip from the top end of the shaft portion to the bottom edge **19** of the blade. In the preferred embodiment, the reinforcement strips **39** and **40** are constructed from fiberglass, most preferably from unidirectional fiberglass.

The next step in the process is to smooth sand or finish sand the replacement blade to provide desired radius or curvature to the edges and to provide the final finished shape of the replacement blade. It should be noted that during this finish sanding step, a minimal amount of the reinforcement strips **39** and **40** is removed since they are positioned within the recessed areas **35** and **36** which have depths approximating the thickness of the strips **39** and **40**. Following this step, the replacement blade can, if desired, be provided with further fabric reinforcement over the exterior surface of the blade **15** and a portion of the shaft **16**. This is done by processes known in the art by utilizing a tubular braid such as that shown by reference character **41** of FIG. **8** or sheets or wrappings of fiberglass or other reinforcement material. Following the application of fiberglass or other reinforcement fabric, the blade is again smooth sanded to remove excess portions of the reinforcement fabric and dipped in varnish.

The final step in the process is to cut the front and back edges 32 and 34 of the outermost end of the shaft 16 to define the hozel or connection end 18 as shown in FIG. 9. The connection end 18 is defined by shoulders 22,22 to limit the distance which the replacement blade can be inserted into the lower end 12 of the handle 10 (FIG. 1) and includes front and back edges 41 and 42 and side surfaces defined by the outer surfaces of the strips 30 and 40. Accordingly, when finished, the side surfaces of the connection end 18 are continuous with the side surfaces of the shaft 16, both of which are formed by the outer surfaces of the reinforcement strips 39 and 40. Preferably, the strips 39 and 40 extend to the bottom edge 19. The finished replacement blade as shown in FIG. 9 includes shoulders 22,22 on the front and back edges of the connection end 18, but is characterized by the absence of shoulders on its side 30 and 31.

Although the description of the preferred embodiment has been quite specific, it is contemplated that various modifications could be made without deviating from the spirit of the present invention. Accordingly, it is intended that the scope of the present invention be dictated by the appended claims rather than by the description of the preferred embodiment.

What is claimed is:

1. A substantially wooden replacement blade adapted for insertion into the lower end of a hockey stick handle, said replacement blade comprising:

a blade portion having top and bottom edges, a pair of blade sides and toe and heel ends;

a shaft portion having a lower end extending from said blade portion, an upper end forming a connection end for insertion into a hollow lower end of a hockey stick handle, a front edge joining with the top edge of said blade portion, a back edge joining with the bottom edge of said blade portion and a pair of shaft sides extending between said front and back edges, said connection end having a free end comprising an uppermost end of shaft portion and a connection end shoulder in at least one of said front and back edges;

a reinforcement strip receiving area and a corresponding reinforcement strip shoulder on each of said pair of shaft sides, each of said reinforcement strip areas extending from said free end, past said connection end shoulder and toward said lower end of said shaft portion and extending from said back edge to its corresponding reinforcement strip shoulder, one of said reinforcement strip shoulders extending between its corresponding reinforcement strip receiving area and one of said blade sides and the other of said reinforcement strip shoulders extending between its corresponding reinforcement strip receiving area and the other of said blade sides;

a reinforcement strip secured to each shaft side in said reinforcement strip receiving area so that each of said reinforcement strips extends from said free end, past said connection end shoulder and toward said lower end of said shaft portion, with an edge of one of said reinforcement strips adjacent to one of said reinforcement strip shoulders and an edge of the other of said reinforcement strips adjacent to the other of said reinforcement strip shoulders.

2. The replacement blade of claim 1 wherein said reinforcement strip receiving areas extend from said free end to said bottom edge of said blade.

3. The replacement blade of claim 2 wherein said reinforcement strip receiving areas converge toward one another as they approach said bottom edge of said blade.

4. The replacement blade of claim 1 wherein said reinforcement strip includes a thickness dimension and wherein the depth of said strip receiving area adjacent to said reinforcement strip shoulder approximates said thickness dimension.

5. The replacement blade of claim 4 wherein each of said reinforcement strip receiving areas extends from said free end to said bottom edge of said blade.

6. The replacement blade of claim 4 wherein each of said reinforcement strip receiving shoulders is generally in line with said front edge.

7. The replacement blade of claim 6 wherein each of said reinforcement strip receiving areas extends from said free end to said bottom edge of said blade.

8. The replacement blade of claim 1 including a fabric reinforcement covering said blade and shaft portions.

9. The replacement blade of claim 1 connected with a hockey stick handle.

10. The replacement blade of claim 4 wherein said reinforcement strip receiving areas extend from said free end to said bottom edge of said blade.

11. The replacement blade of claim 10 wherein said reinforcement strip receiving areas converge toward one another as they approach said bottom edge of said blade.

12. The replacement blade of claim 11 wherein each of said reinforcement strip receiving shoulders is generally in line with said front edge.

13. The replacement blade of claim 12 including a fabric reinforcement covering said blade and shaft portions.

14. The replacement blade of claim 1 wherein each of said reinforcement strips includes a reinforcement strip shoulder in a position corresponding to said connection end shoulder.

15. The replacement blade of claim 1 wherein the thickness of said reinforcement strip is substantially uniform throughout its entire length.

* * * * *

(4) The Court noted that the analysis supporting a rejection under 35 U.S.C. § 103(a) should be made explicit, and that it was "important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the [prior art] elements" in the manner claimed. The Court specifically stated:

> Often, it will be necessary . . . to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an **apparent reason** to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis **should be made explicit.**

KSR, slip op. at 14 (emphasis added).

Therefore, in formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed.

UNITED STATES PATENT AND TRADEMARK OFFICE

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MEMORANDUM

DATE: May 3, 2007

TO: Technology Center Directors

Margaret A. Focarino

FROM: Margaret A. Focarino
Deputy Commissioner
for Patent Operations

SUBJECT: Supreme Court decision on *KSR Int'l. Co., v. Teleflex, Inc.*

The Supreme Court has issued its opinion in *KSR*, regarding the issue of obviousness under 35 U.S.C. § 103(a) when the claim recites a combination of elements of the prior art. *KSR Int'l Co. v. Teleflex, Inc.*, No 04-1350 (U.S. Apr. 30, 2007). A copy of the decision is available at http://www.supremecourtus.gov/opinions/06pdf/04-1350.pdf. The Office is studying the opinion and will issue guidance to the patent examining corps in view of the *KSR* decision in the near future. Until the guidance is issued, the following points should be noted:

(1) The Court reaffirmed the *Graham* factors in the determination of obviousness under 35 U.S.C. § 103(a). The four factual inquiries under *Graham* are:
- (a) determining the scope and contents of the prior art;
- (b) ascertaining the differences between the prior art and the claims in issue;
- (c) resolving the level of ordinary skill in the pertinent art; and
- (d) evaluating evidence of secondary consideration.

Graham v. John Deere, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966).

(2) The Court did not totally reject the use of "teaching, suggestion, or motivation" as a factor in the obviousness analysis. Rather, the Court recognized that a showing of "teaching, suggestion, or motivation" to combine the prior art to meet the claimed subject matter could provide a helpful insight in determining whether the claimed subject matter is obvious under 35 U.S.C. § 103(a).

(3) The Court rejected a rigid application of the "teaching, suggestion, or motivation" (TSM) test, which required a showing of some teaching, suggestion, or motivation in the prior art that would lead one of ordinary skill in the art to combine the prior art elements in the manner claimed in the application or patent before holding the claimed subject matter to be obvious.

X. RELATED PROCEEDINGS APPENDIX

The Appeal Brief with exhibits of Application Serial No. 10/439,652, filed June 13, 2007, is attached hereto.